OCTOBER 1925

MECCANO MAGAZINE

Famous Bridges.

(See page 494.)

No. 10
VOL. X

3D

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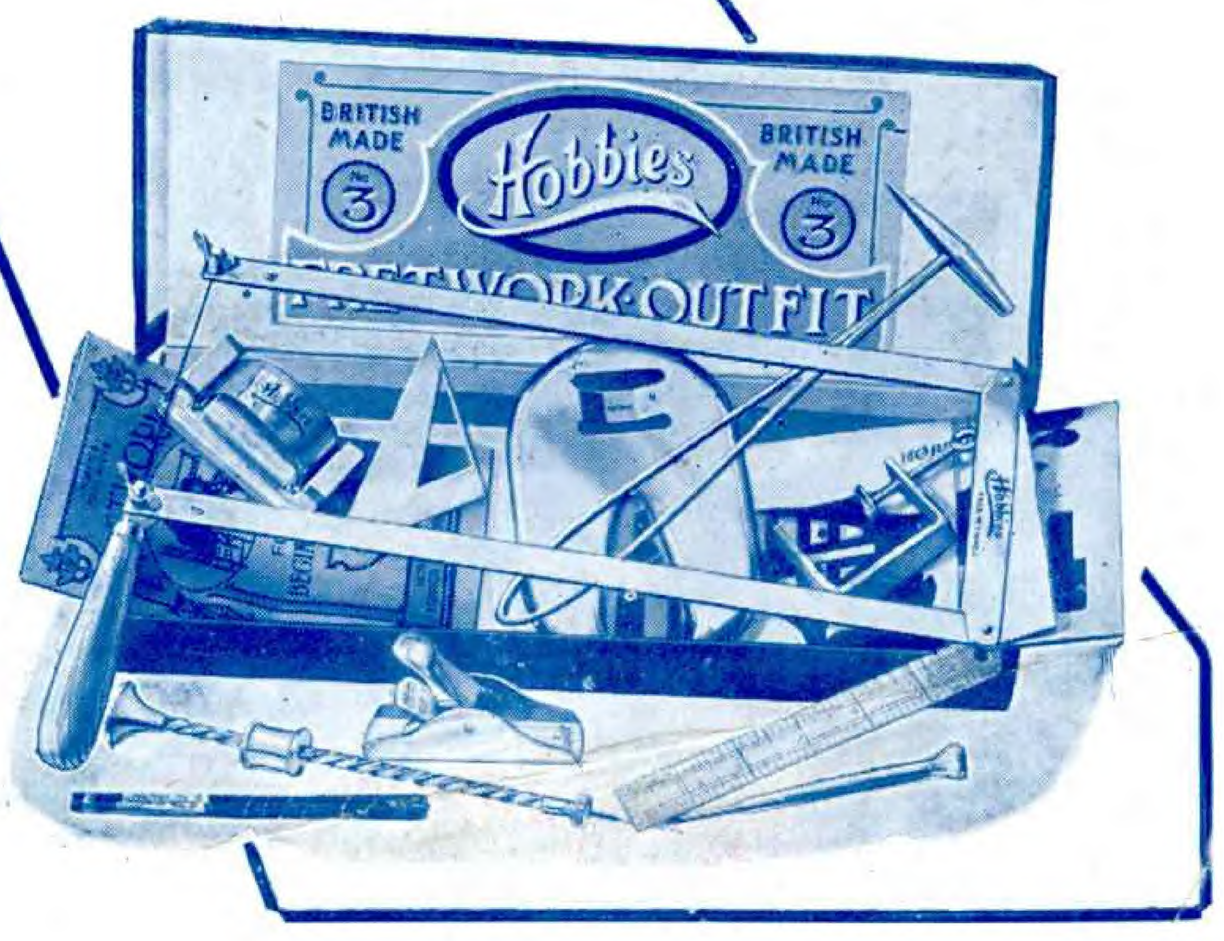
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EDITORIAL OFFICE
Binns Road,
LIVERPOOL

Vol. X, No. 10

MECCANO MAGAZINE

PUBLISHED
IN THE INTERESTS
OF BOYS

October 1925

With the Editor

Model-Building Competitions

As most of our readers know, our annual Model-building Competition is not being organised this year. Instead, in response to hundreds of requests, I am arranging a splendid series of model-building competitions in these pages. The first of these contests is announced this month and I hope that all Meccano boys will get out their Outfits at once, evolve ingenious models, and send along photographs or drawings of them.

All entries will be examined first by our Competition Staff but the final judging will be done by Mr. Frank Hornby, our Managing Director and the inventor of Meccano. A special point will be made of publishing photographs and descriptions of the prize-winning models and other models of merit.

Briefly, the idea is to run two competitions each month. The first will be for the best model made with a specified Outfit, and the second for some particular type of model. This month, for instance, the first competition is for the best model made with a No. 0 Outfit and the second competition for the best model of a locomotive. Next month we shall probably announce a competition for the best model built with a No. 1 Outfit and some other well-known structure—a bridge, ship, etc.—will form the subject of the second competition.

Full particulars are announced on page 531, and I hope that these competitions will be as popular as the great Model-building Contests have been in the past.

Roman Engineers in Britain

Some months ago I mentioned a Roman road that I saw when on a walking tour in East Yorkshire. I am sure that the many readers who wrote expressing their interest in my remarks will be interested in another of my recent walks, this time across England from the Tyne to the Solway. I travelled along the line of the Roman Wall, built by Hadrian about 122 A.D. The construction of this Wall, approximately 75 miles in length, 18 ft. in height and 6 ft. in breadth, was a tremendous feat of engineering.

The Wall was faced on the north and south sides by masonry blocks, quarried from various points along the line of the wall. At every Roman mile, or every seven furlongs of our present standard of measurement, mile-castles, or little forts were built, while the ruins of several larger forts and camps are to be seen on the south side of the wall.

Among the more interesting things that I saw were stones worn away where the Roman soldiers had sharpened their knives and swords, and the kerb stones, at the southern gate of one of the Roman camps, still showing the ruts made by the Roman chariot wheels—which, incidentally, were of the same gauge as those at Pompeii. Altogether it was a very fine walk. The district is very wild but the scenery in many places is magnificent and in some future issue I hope to give a more detailed account of this great work of the Roman engineers. As I obtained a large number of photographs I think a very interesting article will result.

Overseas Readers Please Note

Overseas readers are reminded that the prices shown throughout the advertisements in the "*M.M.*" relate only to the prices of the goods in the home market. This refers not only to the price of Meccano products advertised, but (as a general rule) to all other goods advertised in the Magazine. There are several reasons for overseas prices being higher, chiefly the extra cost entailed by carriage and the customs charges or import duties levied by the governments of the various countries.

As far as Meccano products are concerned, a current Overseas Price List will be mailed free on request by any of our agents, whose addresses will be found on page 552 and advertisers of other goods will, no doubt, send their overseas price lists on application or confirm that there is no extra charge entailed.

I hope that my overseas readers will take due notice of this announcement, for although a notice to this effect appears every month on the last page of the Magazine, it seems that many readers overlook it. A considerable amount of unnecessary correspondence is caused by readers writing to our Overseas agents and ordering Meccano goods at home market selling prices.

For Meccano Model-Builders

I feel sure that all Meccano boys will be interested to hear of a new feature that will commence in our November issue. This is a description of various standard Meccano mechanisms that are constantly required by keen model-builders.

Such things as the various forms of gearing obtainable with Meccano parts, brakes, pulley-blocks, levers, belt and chain drives, ball-bearings, roller-bearings, and other mechanisms, will be dealt with in turn. These mechanisms are standard—that is to say that they may be applied to more than one model, and it is with a view to making model-building easier that the articles are being published.

I have had this series of articles in mind for several years and have been collecting material for it for some time. I feel sure that the series will meet with an enthusiastic response from all Meccano boys. The articles will be published in book form later and in this connection I hope to make a further announcement in the near future. Meantime, next month the series will commence with a description of gear ratios and belt and rope mechanisms.

Have You a Bright Idea?

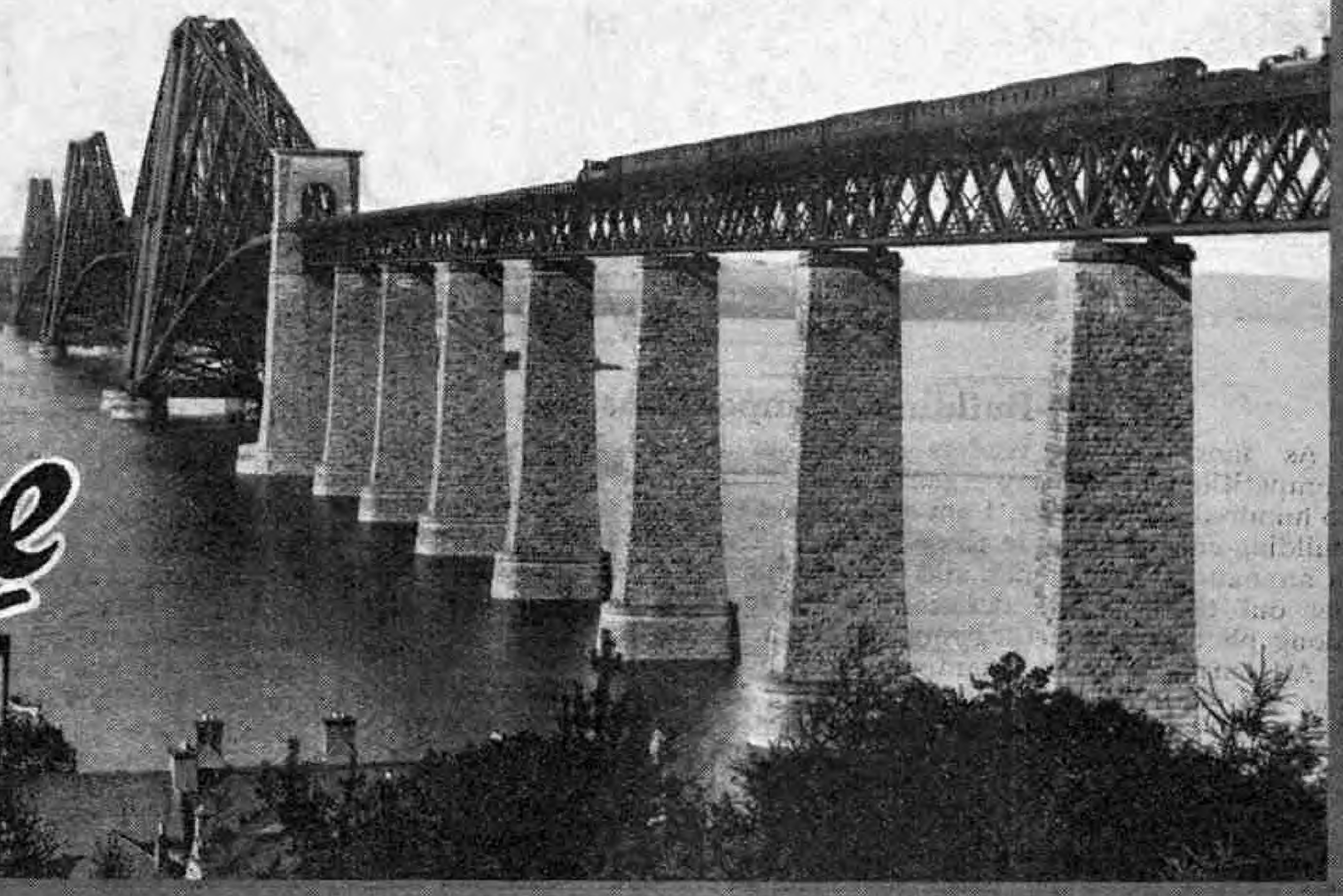
For some time I have been anxious to devote a greater amount of space to the popular "Bright Ideas" column—one of our oldest features. I am making arrangements that will, I hope, render this possible. In the near future I shall endeavour to devote a page to this subject, and the present column of replies to readers will be continued and, if possible, extended. In addition, I hope to be able to publish in a more detailed form a selection of the most interesting ideas submitted.

When the long evenings come, my readers turn with renewed interest to Meccano—old models are re-built with modifications and improvements and new models are designed. I want readers to write and tell me about their ideas and their inventions in this connection, and useful prizes will be awarded for the "brightest" idea of the month. I shall be glad to receive descriptions of any new or improved models, especially if these are accompanied by sketches or photographs. Apart from model-building I know that many readers employ Meccano parts for a hundred-and-one other purposes, such as the construction of articles for household use, or for use in some particular hobby—such as Radio—and I shall welcome descriptions of any articles of this nature.

I believe that a "Bright Ideas" page of this kind will add greatly to the value and interest of the "*M.M.*" to model builders. In the meantime I shall be glad to have any suggestions towards making the page of general interest. Mark your envelopes "Bright Ideas Editor."

FAMOUS BRIDGES V.

The Story of the Forth Bridge



THE Forth Bridge, which forms the subject of our cover, is one of the engineering wonders of the world. Up to 1917 it held the proud position of possessing the longest span of all the world's bridges, and although in that year it had to yield pride of place in this respect to the Quebec Bridge, it has lost nothing of its fame as a glorious example of British engineering skill.

In this article we commence the story of the great cantilever bridge that spans the Firth of Forth and dominates the landscape for miles around. This bridge, which was opened in March 1890 seven years after the commencement of the works, is one of the most impressive structures in the world and its story is one of great engineering interest.

Previous to the construction of the Forth Bridge travellers wishing to go from Edinburgh to the counties of Fife and Perth were obliged either to make a long detour by way of Stirling or to cross the Firth of Forth by ferry steamer. Either of these courses involved a great loss of time and as traffic increased it became evident that some means of direct communication across the Forth must be found.

First Proposal for a Bridge

As far back as 1805 it was proposed to drive a double tunnel beneath the bed of the Forth, but this scheme came to nothing. The first suggestion for a bridge appears to have been made in 1818, when an engineer named James Anderson proposed the construction of one at Queensferry. This bridge was to be 33 ft. in width with main spans of from 1,500 to 2,000 ft. in length. This scheme also fell through and nothing further was done in the matter until 1860, when the North British Railway planned a bridge of 500 ft. spans some six miles from South Queensferry. This project never took shape, but in 1873 the idea was revived and the Forth Bridge Company was formed with the object of building a suspension bridge to the design of Sir Thomas Bouch, the engineer of the first Tay Bridge.

The proposed bridge was to have two spans of 1,600 ft. each, a clear headway of 150 ft., and towers 550 ft. above high water on the island of Inchgarvie and on the two shores. The necessary Act of Parliament authorising the scheme was passed and work commenced on the foundation of the main pier on Inchgarvie island. Then, on 29th December, 1879, occurred the terrible disaster to the Tay Bridge.

The Tay Bridge Disaster

This bridge was begun in 1871 and opened for traffic in 1878. It crossed the estuary of the Tay at Dundee, forming a connecting link between Fifeshire and Forfarshire. It consisted of 85 spans, its total length being 10,700 ft., and it carried a single line of railway. Eighteen months after the bridge was opened, its thirteen central spans, each 245 ft. long, were blown down while a mail train was crossing. The train was precipitated into the water 90 ft. below and 75 people perished. This appalling calamity destroyed all confidence in Sir Thomas Bouch and work on the new bridge was stopped immediately.

Various other means of crossing the Forth were then considered and finally, in 1881, approval was given to plans for a bridge on the cantilever system submitted by Messrs. Fowler and Baker, afterwards respectively Sir John Fowler and Sir Benjamin Baker. Parliamentary sanction for the bridge was obtained in 1873 and the work was entrusted to Messrs. Tancred, Arrol and Co., now Sir William Arrol and Co., of Glasgow. The contract was signed in December 1882 and work was commenced in the following month.

The Cantilever Principle

In order to appreciate fully the magnificence of the Forth Bridge it is necessary to know something of the principle of the cantilever. The name is derived from the French "*cant*" meaning angle and "*lever*" to raise. The principle is a very old one, having been used hundreds of years ago in China, Japan and India. These early structures were, of course, very primitive, and the type developed little until comparatively recent years.

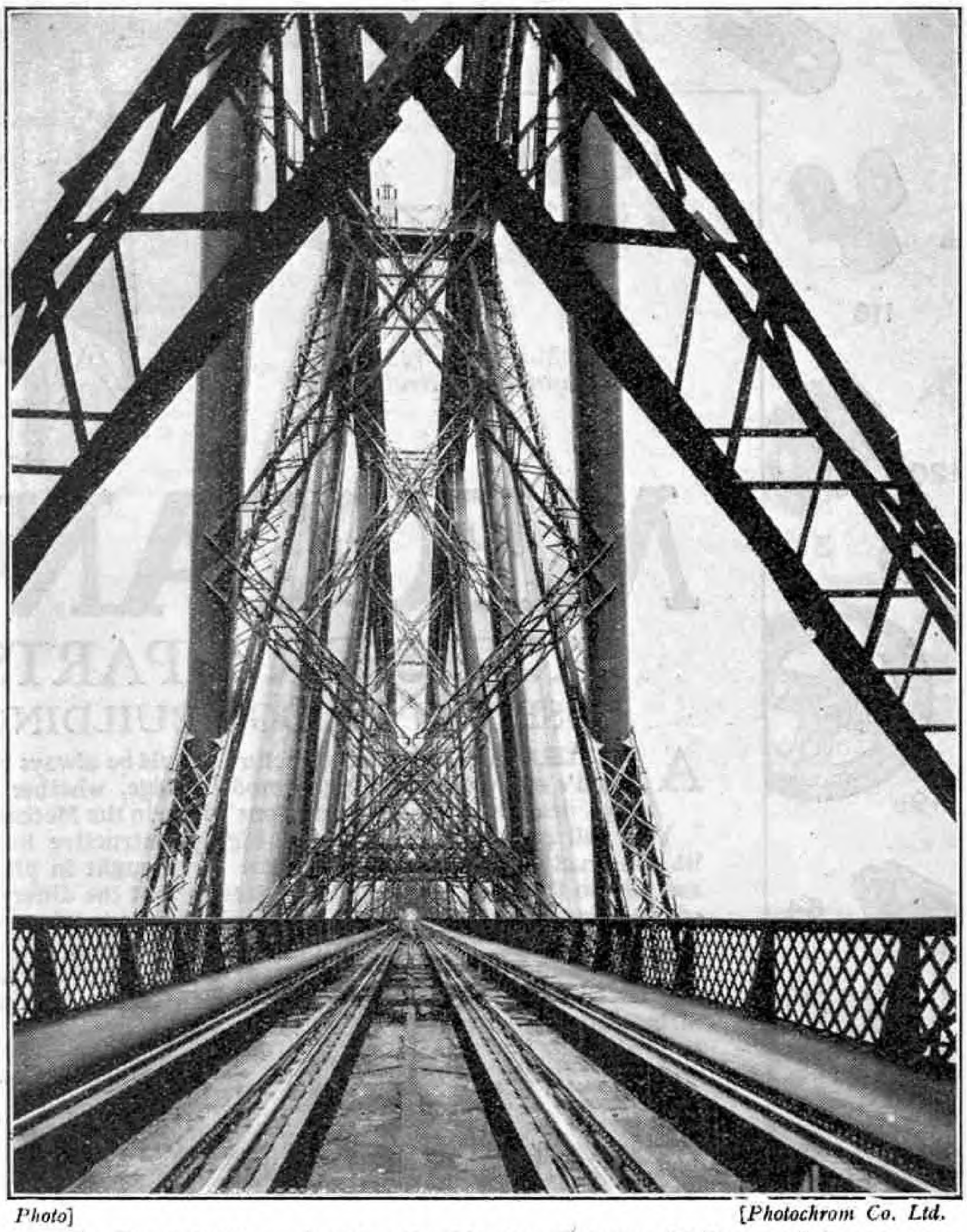
An excellent description of the cantilever principle was given by Sir Benjamin Baker at the Royal Institution in the course of a lecture on the Forth Bridge. On this occasion the lecturer exhibited what he called a living model of the Forth Bridge arranged as follows:—

"Two men sitting on chairs extended their arms and supported the same by grasping sticks butting against the chairs. This represented the two double cantilevers. The central beam was represented by a short stick slung from the near hands of the two men, and the anchorages of the cantilevers by ropes extending from the other hands of the men to a couple of piles of bricks. When stresses were brought to bear on this system by a load on the central beam, the men's arms and the anchorage ropes came into tension, and the sticks and chair legs into compression.

"In the Forth Bridge it is to be imagined that the chairs are placed one-third of a mile apart; that the men's heads are 340 feet above the ground; that the pull on each arm is about 4,000 tons; the thrust on each stick over 6,000 tons, and the weight on the legs of the chair over 25,000 tons."

The diagram on page 497 illustrates well the foregoing description and if carefully examined will make the principle quite clear. The great advantage of the cantilever system is that it permits the cantilever arms to be built out in pairs on each side of their towers in such a manner as to balance one another during construction, thus rendering external support unnecessary.

The Forth Bridge as erected consists of two approach viaducts; three double cantilevers resting on two piers near the shore and on a central pier on the island; and two pairs of girders spanning the intervals between the ends of the central and side cantilevers over the channels. The South Approach viaduct has ten spans of 168 ft. each and four arches of 66 ft. each, and the North Approach viaduct has five spans of 168 ft. and three arches of various sizes.



Photo] [*Photochrom Co. Ltd.*

On the Forth Bridge, showing the Massive Tubular Girders and the cross-bracings of lattice-braced girders

Constructional Details

The cantilever portion of the bridge includes three huge double cantilevers and two intervening suspended spans. This portion of the bridge measures about 5,349 ft. 6 in. The cantilevers are symmetrical steel structures rising 361 ft. above high water level, that is nearly as high as St. Paul's Cathedral. They are composed of a central portion over the piers from which two cantilever arms extend out on each side for a distance of 680 ft., tapering at their extremities, both horizontally and vertically.

The central portions of the cantilevers consist of four columns each resting upon a circular granite pier. These piers are 120 ft. apart at the base and 33 ft. apart at the summit. Longitudinally, the columns of the central pier on the rock island of Inchgarvie are 260 ft. apart from bottom to top, while those of the two side piers are 145 ft. apart. The vertical columns are connected at the top and the bottom and braced together horizontally and vertically. The cantilever arms are composed of two curved steel tubes at the bottom in compression and two flanged lattice steel ties at the top, in tension, braced together vertically and horizontally.

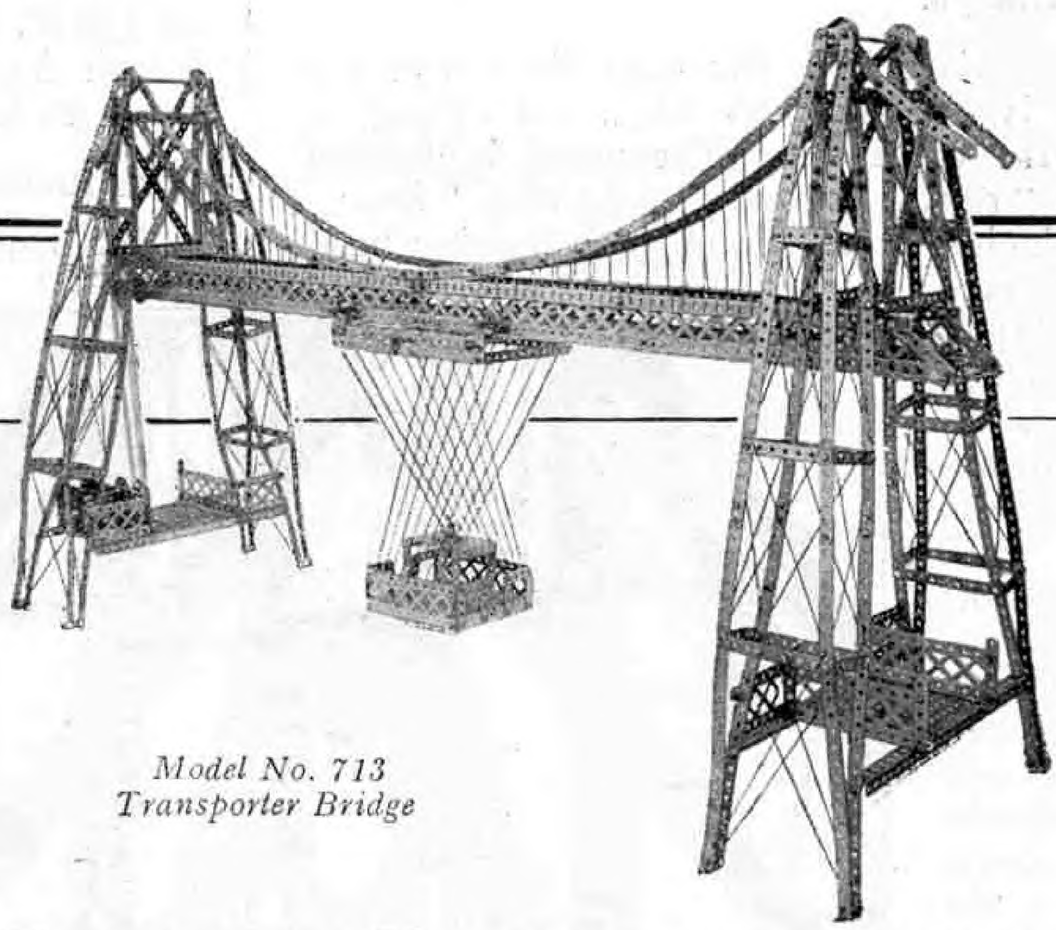
The ends of the cantilevers reaching out over the channels serve to support girders of 350 ft. span which complete the communication between the cantilevers over the channels, cantilevers and girders together forming a bridge with two clear openings of 1,710 ft. between the piers.

Two lines of railway with a footpath on each side run through the cantilever arms.

Millions of Rivets

The total length of the bridge, together with the approach viaducts, is about 8,296 ft., and the piers carry a total weight of 50,958 tons of steel. Sir Benjamin Baker stated that six battleships could be safely suspended from the cantilever ends. The superstructure contains about 6½ million rivets; 65,000 cubic

(*Continued on page 497*)



Model No. 713
Transporter Bridge

MECCANO

ACCESSORY PARTS

USED IN BRIDGE BUILDING

A PICTURE of the finished structure should be always before your mind's eye whilst building a model bridge, whether from your own designs or from instructions given in the Meccano Manual. You will pass many happy and highly instructive hours during its construction, and by using a little forethought in placing struts and ties so that they withstand the stresses that the different sections of the model must bear, you will build a bridge of such strength that you could stand upon it with perfect confidence.

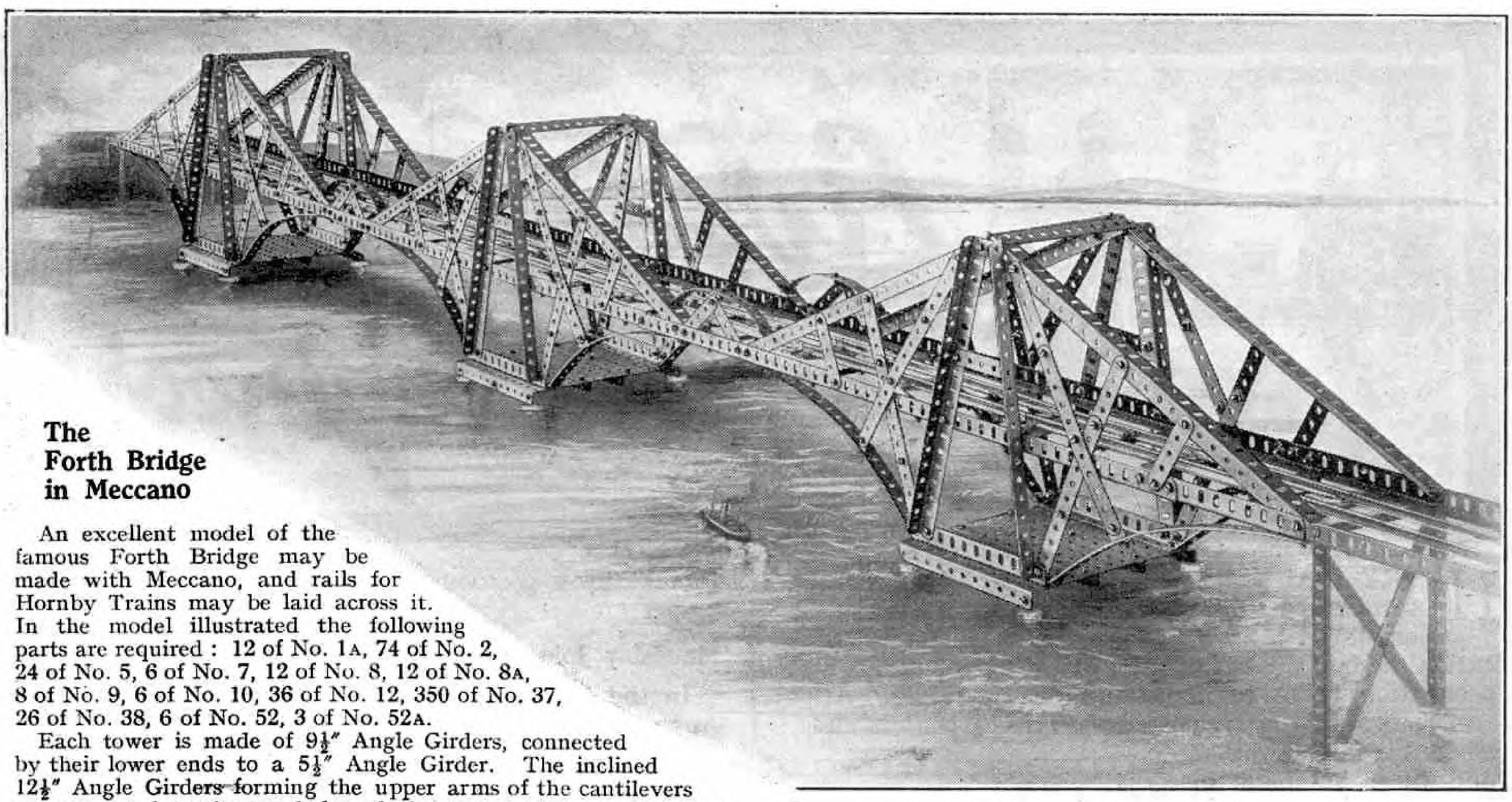
Bridge building requires girders of all descriptions and sizes—Braced Girders, Angle Girders, and girders built up from Meccano Strips and smaller parts.

No.			s.	d.
1.	12½"	Perforated Strips ½ doz.	1	0
1A.	9½"	" " "	0	9
1B.	7½"	" " "	0	8
2.	5½"	" " "	0	6
2A.	4½"	" " "	0	5
3.	3½"	" " "	0	4
4.	3"	" " "	0	3
5.	2½"	" " "	0	3
6.	2"	" " "	0	3
6A.	1½"	" " "	0	3
7.	24½"	Angle Girders ... each	0	8
7A.	18½"	" " ... "	0	6
8.	12½"	" " ... ½ doz.	1	9
8A.	9½"	" " ... "	1	3
8B.	7½"	" " ... "	1	2
9.	5½"	" " ... "	1	0
9A.	4½"	" " ... "	0	10
9B.	3½"	" " ... "	0	8
9C.	3"	" " ... "	0	8

No.			s.	d.
9D.	2½"	Angle Girders ... ½ doz.	0	7
9E.	2"	" " ... "	0	6
9F.	1½"	" " ... "	0	6
97.	3½"	Braced Girders "	0	9
98.	2½"	" " "	0	6
99.	12½"	" " "	1	9
99A.	9½"	" " "	1	6
100.	5½"	" " "	1	0
103.	5½"	Flat Girders ... "	1	0
103A.	9½"	" " ... "	1	6
103B.	12½"	" " ... "	2	0
103C.	4½"	" " ... "	0	9
103D.	3½"	" " ... "	0	7
103E.	3"	" " ... "	0	6
103F.	2½"	" " ... "	0	5
103G.	2"	" " ... "	0	4
103H.	1½"	" " ... "	0	3
103K.	7½"	" " ... "	1	3
113.		Girder Frames ... each	0	2

Ask your Dealer for a complete list or write for one direct to

MECCANO LTD., Binns Rd., LIVERPOOL



The Forth Bridge in Meccano

An excellent model of the famous Forth Bridge may be made with Meccano, and rails for Hornby Trains may be laid across it. In the model illustrated the following parts are required : 12 of No. 1A, 74 of No. 2, 24 of No. 5, 6 of No. 7, 12 of No. 8, 12 of No. 8A, 8 of No. 9, 6 of No. 10, 36 of No. 12, 350 of No. 37, 26 of No. 38, 6 of No. 52, 3 of No. 52A.

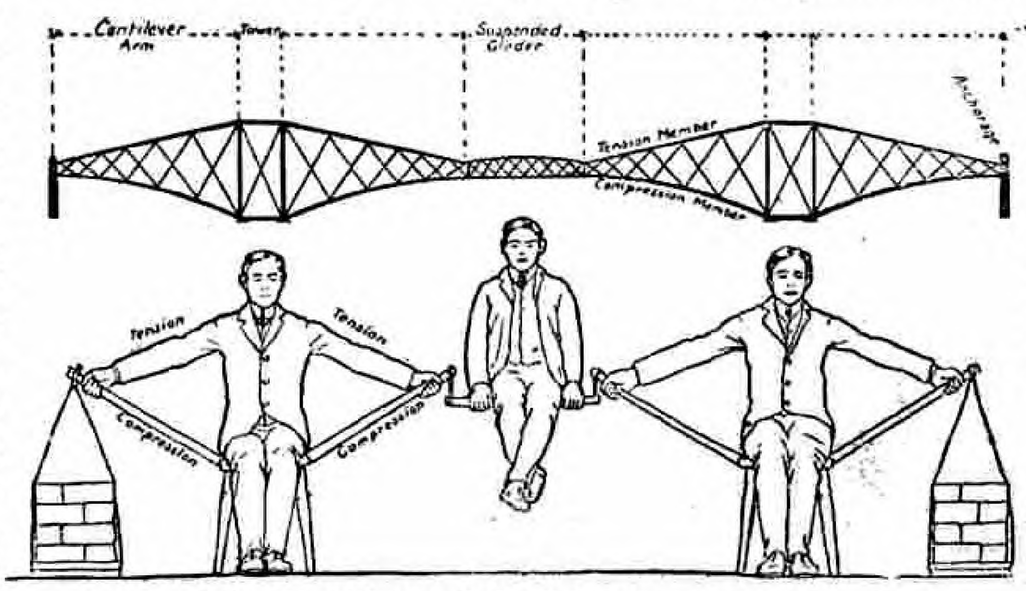
Each tower is made of 9½" Angle Girders, connected by their lower ends to a 5½" Angle Girder. The inclined 12½" Angle Girders forming the upper arms of the cantilevers are connected to the top holes of the tower girders, which are coupled by Flat Brackets, and at their lower outer ends to horizontal Angle Girders. The horizontal girders are connected across by 5½" Strips disposed at intervals of about 11 holes apart. On these are secured gauge 0 track rails, held to the cross strips by bolts, beneath the heads of which are Washers engaging the lower flange of the track rails and binding them on to the cross strips.

The bases of the towers are formed by two 5½" Flanged Plates coupled at the centre by a 5½" Flat Plate.

The Story of the Forth Bridge—(*continued from page* 495)

yards of concrete ; 49,000 cubic yards of rubble and 750,000 cubic feet of granite. The Inchgarvie tower contains about 7,036 tons of steel and the other towers each about 4,815 tons.

The bridge is painted once every three years and the extent of this task may be realised from the fact that the total area to be painted inside and outside is 145 acres. The whole of the outer surface of the bridge was covered five times during construction—once with boiled linseed oil, twice with red lead and twice with oxide of iron paint. The total building period was about seven years and at the busiest times no less than 4,600 workmen were employed. As might be expected, the building of such a huge structure involved many dangerous operations. During the whole period of construction 57 fatal accidents occurred and 106 serious but not fatal accidents.



The Cantilever Principle Demonstrated

(From the Editor's book: "*Engineering for Boys*," by permission of the publishers)

The total cost of the bridge was £3,600,000.

Gigantic as is the Forth Bridge, its dimensions are exceeded in some respects by the famous Quebec cantilever bridge across the River St. Lawrence. The total length of the main span of this bridge is 1,800 ft. or 90 ft. greater than that of the famous Scottish bridge.

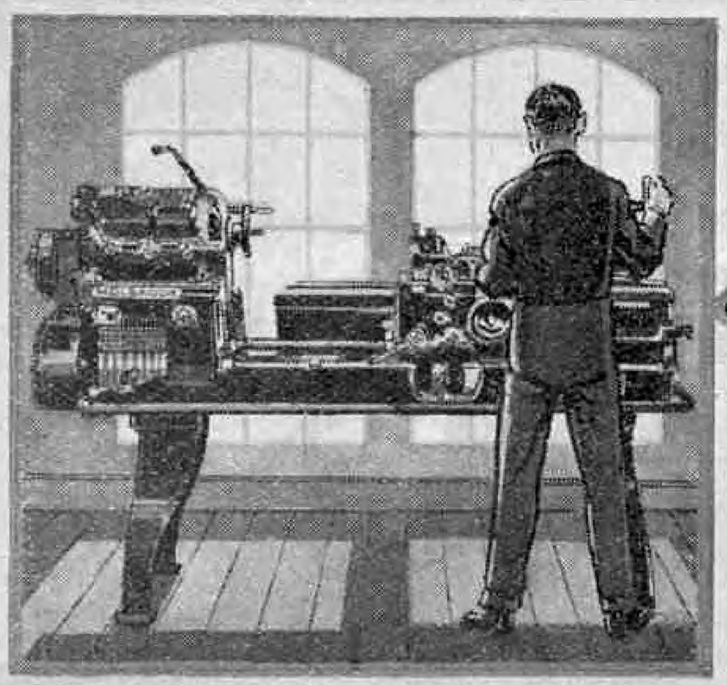
Although, as we have seen, a number of fatal accidents occurred during the building of the Forth Bridge, yet from first to last the work proceeded without any great disaster. In this respect the Quebec Bridge presents a great contrast.

The first bridge was commenced in 1900 and the sub-structure was completed two years later. From that time the erection of the steelwork proceeded rapidly and without interruption until 29th August, 1907, when a terrible disaster occurred. On the afternoon of that day, while work was in full progress, the lower chords in the anchor arms buckled up without any warning and 17,000 tons of steel collapsed with a report that was heard many miles away. The 86 men working on the arm at the time went down with it and of these only 11 were saved. This terrible accident came as a great shock to the engineering world, and it made a profound impression on the general public.

Matters were not allowed to remain there, however, and after the causes of the disaster had been carefully investigated, preparations were made for building a new bridge and two years later work was commenced. This time all went well until 11th September, 1916, when a second, but fortunately less serious disaster occurred.

The central span had been floated into position upon the pontoons and the hoisting chains were in position. Hydraulic jacks then raised the span until the load was taken off the pontoons, which then floated away. Work proceeded according to plan until the span was 30 ft. above the water, when something failed at the south-west corner. With a terrible crash that corner dropped into the water, and desperate efforts made to prevent its further progress were without avail.

(*To be continued*)



Lives of Famous Engineers

XXI
Henry Maudslay and MACHINE TOOLS

HENRY MAUDSLAY was born at Woolwich on 22nd August 1771, his father being at that time employed at the Arsenal. After a scanty education the boy was set to work at the age of 12, his first occupation being to make and fill cartridges. After two years of this he was passed on to the carpenters' shop, where his father worked, and there he made his first acquaintance with tools and the art of working in wood.

Henry Maudslay may be regarded as the father of the modern precision machine tool. He was a craftsman of the finest type, always striving after greater perfection of workmanship and regarding first-rate work as a duty. Nasmyth said of him that his character could be seen in every piece of work he produced.

Training at Woolwich

The blacksmiths' shop happened to be situated close to the carpenters' shop and from the first it exercised a great fascination over Maudslay. Working in iron appealed to him far more strongly than working in wood, and the result was that he took every opportunity of stealing away from his own work to the blacksmiths' shop. These disappearances earned him many a box on the ears from the foreman carpenter, but Maudslay persisted and at the end of a year, at his earnest desire, he was moved from the carpenters' shop and placed in the smithy.

This transfer had a great effect on Maudslay's life. His heart was in his new work and he made such rapid progress as to astonish all his fellow workers. He soon became an expert smith and metal worker and was particularly skilful in forging light iron work. After a time his reputation as a craftsman spread even into the London shops, and this resulted in his departure from Woolwich Arsenal, to take up a position in which his ability had greater scope.

Maudslay Joins Bramah

In the account of the life of Joseph Bramah in our August issue, we drew attention to the difficulty Bramah experienced in getting his patent lock manufactured with sufficient precision and at the same time in sufficient quantities and at a reasonable price. Bramah found that even the best manual dexterity was not reliable, and on the other hand machine tools of sufficient accuracy had not at that time been invented.

For a time Bramah was in a great dilemma, but one day, while he was discussing his difficulty with a well-known blacksmith, a hammerman in the shop suggested that there was a young man named Maudslay in the smithy at Woolwich Arsenal who might be able to solve the problem. Bramah immediately sent for Maudslay and found to his surprise that he was only a lad of 18 years. It was difficult to believe that such a youth would be able to help him, but he stated his case, and Maudslay's replies and suggestions were so helpful and practical that Bramah immediately offered him a job in his workshop and Maudslay gladly accepted the offer.

Convincing the Foreman

Maudslay had served no regular apprenticeship and this fact, together with his youthful appearance, made the foreman of the shop very doubtful about his ability to work alongside the experienced hands. Maudslay realised at once what was troubling the foreman

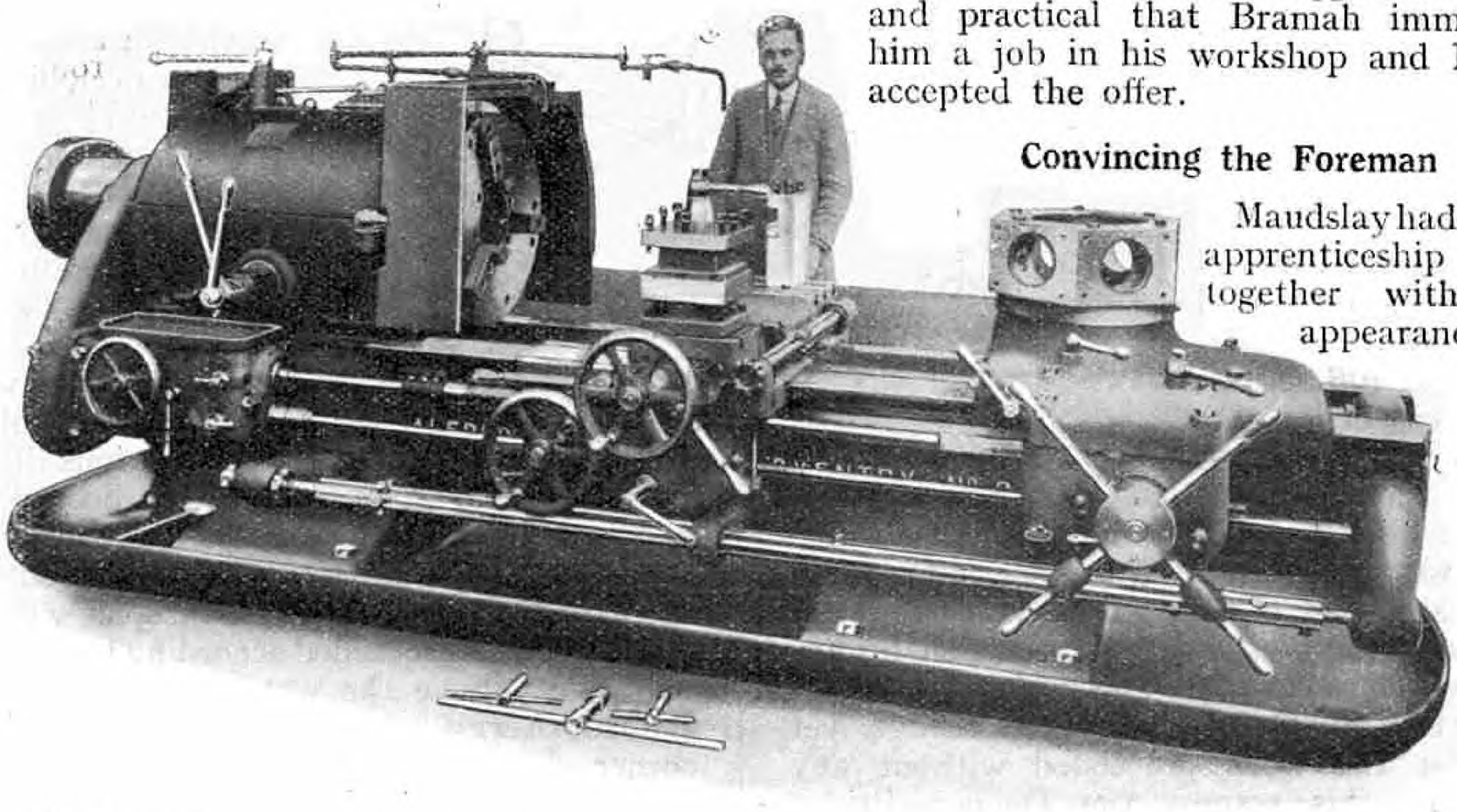


Photo courtesy [*Messrs. Alfred Herbert Ltd.*

Combination Turret Lathe with Chuck and Pump

and pointing to a worn-out vice-bench he said to Bramah : " Perhaps if I can make that as good as new by 6 o'clock to-night it will satisfy your foreman that I am entitled to rank as a tradesman and take my place among your men, even though I have not served a seven years' apprenticeship."

This proposal was so reasonable that it was at once agreed to, and Maudslay immediately set to work upon the old bench. By 6 o'clock the old vice had been restored to its former efficiency and the old bench looked so smart as to throw the neighbouring benches into the shade. Bramah and his foreman examined the bench carefully and pronounced it " a first-rate job," and Maudslay was immediately accepted as one of the regular hands.

Shortly after Maudslay entered Bramah's service his father died and from that time he used to walk to Woolwich every Saturday night to hand over to his mother a considerable share of his week's wages and this practice he continued until his mother's death.

Commences Business for Himself

Maudslay soon ranked in the shop as a first-class workman and became a general favourite. He was raised from post to post until finally, by unanimous consent of his fellow workers, he was appointed head foreman of the works. He was now Bramah's right-hand man and one of the first really difficult problems that he tackled and solved was that of devising tools for making the Bramah patent lock. He also invented the self-tightening collar for Bramah's hydraulic press without which, as we saw in our August issue, the press could not have been made efficient.



Henry Maudslay

During the time that Maudslay acted as manager of Bramah's works his wages were never more than 30/– a week. He applied to Bramah for an advance but his application was refused, and in such a manner as to make him determine to leave Bramah and commence business on his own account. He made a start in 1797 in a small workshop in Wells Street, off Oxford Street, and it was not long before he was fully employed.

Maudslay's ambition had been for some time to produce improved machine tools that should be as far as possible self-acting and self-regulating, and which would to a great extent make up for carelessness or lack of skill on the part of the workmen. While engaged upon this problem he produced the mechanical invention with which his name is usually identified—the slide rest. The first device of this kind was contrived by him for Bramah, but afterwards it underwent many modifications and improvements.

Invention of Slide Rest

In turning a piece of work on the lathe of that period, the workman had to apply and guide the tool himself. After long practice the best workmen acquired great skill and were able to turn out good work. If the article to be turned was of considerable size, however, and particularly when it was of metal, the strain upon the workman was very great. The slightest variation in the pressure of the tool produced irregularity of surface, and even the most skilled workmen were unable at times to avoid cutting a little too deep.

Maudslay's slide rest was designed to provide a remedy for this state of affairs. The principle of his invention consisted in constructing and fitting the rest so that, instead of being screwed down and the tool guided by the workmen travelling over it, the rest itself held the cutting tool and slid along the bench in a direction exactly parallel with the axis of the work.

The adoption of the slide rest at once made more perfect and uniform work possible, and before long the effects of the invention were felt in all departments of mechanism. As might have been expected, a certain section of the older workmen ridiculed the slide rest and spoke of it as " Maudslay's Go-cart," but its universal adoption in all workshops was only a matter of time.

Maudslay's business flourished and he removed to larger premises in Westminster Road, Lambeth, where he built up the famous establishment of Maudslay, Field & Co. There he steadily continued to improve his old machine tools and to invent new ones, and the scope of his business extended until it included machinery of every description.

Improvements in Steam Engines

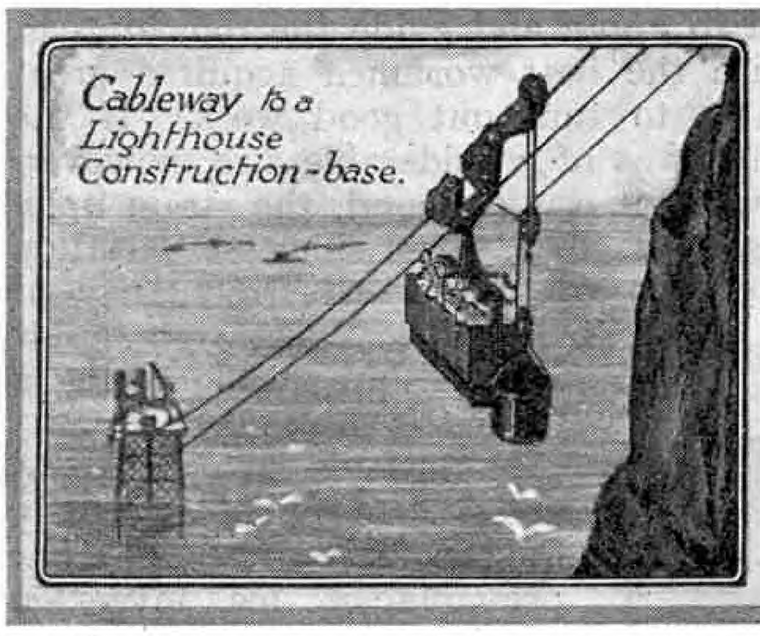
In 1807 Maudslay took out a patent for improvements in the steam engine, by which he simplified its parts and secured greater directness of action. He also gave a good deal of attention to improving the marine engine, and the " Regent," which was the first steamboat that plied between London and Margate, was fitted with engines by Maudslay in 1816.

Another of his important inventions was a machine for punching boiler plates by means of which the holes punched in the plate were exactly equidistant and the subsequent riveting was greatly facilitated.

Screw-Cutting Machinery

The importance of Maudslay's work in connection with screw-cutting must not be overlooked. Before he took the matter in hand there had been no system of proportioning the number of threads of screws to their diameter. The result was that each nut and bolt formed a distinct partnership and were not interchangeable with neighbouring nuts and bolts. As may be imagined, any mixing up of nuts and bolts when

(Continued on page 526)



Engineering News of the Month

£220,000 Fire

A large number of river craft, trawlers and canal steamers, the total value of which is estimated at over £220,000 were recently destroyed by fire at the harbour and shipyard of Hisingsstaden.

* * * *

New Canadian Dry Dock

The Canadian Government new dry dock at Esquimault, Vancouver Island, B.C., which has cost over £1,000,000, is now nearing completion. The dimensions of the new dock are to be 1,150 ft. in length, 149 ft. across the top, 123 ft. in width at the bottom, and 40 ft. in depth at high tide. It will be the second largest dry dock in the world.

* * * *

New Motor Ship

The motor ship "*Port Dunedin*," constructed by Messrs. Workman, Clark & Co. Ltd., of Belfast, to the order of the Dominion and Commonwealth Line, has recently undergone satisfactory trials at sea. The new vessel, which is of the shelter deck type, is 465 ft. in length, 59.5 ft. in breadth and 43.75 ft. in depth, and is of 10,500 tons dead-weight. Five large holds and upper and main 'tween decks are arranged for the carriage of cargo. All but two of the holds are insulated for the carriage of refrigerated produce. Extensive storage for oil fuel is included, the necessary piping being accommodated in a duct keel.

The propelling machinery, installed by the builders, consists of two sets of four cylinder, two-stroke cycle, solid injection Doxford opposed piston oil engines. The engine room auxiliaries are driven by electricity, supplied at 220 volts by three four-cylinder Diesel-driven generating sets.

* * * *

Remarkable Shipbuilding Feat

A remarkable feat in rapid ship construction was recently achieved by the Furness shipyard on the Tyne. Fifteen weeks after the laying of her keel, a 2,500-ton vessel, for service on the Canadian lakes, passed her trials and was loading her first cargo.

* * * *

New Cement Factory

Contracts for the establishment of a new factory at Dunstable, capable of an annual output of not less than 110,000 tons of Portland cement, have been placed with the Cleveland Bridge and Engineering Co. Ltd., of Darlington. The firm is to be responsible for the preparation of the site, provision of foundations, railway sidings and roads, and for the manufacture and erection of the works buildings. Cement-making machinery will be supplied by Edgar Allen and Co., of Sheffield. This machinery will comprise two units, each complete with raw material plant, 200 feet rotary kiln and combination cement grinding mill. Turbopulverisers will be used for pulverising and firing the coal to the kiln, and electric driving will be adopted throughout in conjunction with the latest systems of mechanical handling, bag packing, and transport appliances.

* * * *

Oil or Coal as a Fuel

In a paper on the Llandacey Oil Refinery Works, Sir John Cadman, K.C.M.G., recently expressed his opinion that coal will ultimately take its place with oil as a fuel almost equally mobile and flexible. Recent experiments, he said, indicated that this expectation was already in process of realisation. He had never regarded oil as a rival of coal, but rather as an ally and associate, though petroleum would always maintain a premier place in certain applications for which it was specially suited.

* * * *

Engineers for Motorships

It was recently announced that the problem of finding sufficient qualified engineers to staff the increasing number of motorships that are being put into service is now engaging the serious attention of shipowners. Quite recently an engine-room staff was required for a motorship leaving a North-East Coast port, but it was only after a somewhat lengthy search in various other ports that men with the necessary qualifications were secured. It is proving extremely difficult to obtain chief engineers able to take berths on this type of vessel, although a large number of sea-going engineers with steam experience are unemployed.

One of the leading shipping firms has adopted a scheme whereby it is hoped to guard against difficulty in manning new motorships added to their fleet in the near future. Their motorships carry a much larger engine-room staff than is necessary and instead of the usual complement of greasers, a number of engineers with steam experience perform the work of greasers. They receive engineers' rates of pay and at the same time obtain the experience necessary to qualify as engineers on internal-combustion-engined ships.

The number of motorships will certainly increase with any revival in international trade, and this opening is one that readers should bear in mind.

* * * *

A New Ship's Rudder

A new ship's rudder recently patented, has an arrangement of trap doors that may be opened at will. When opened the pressure of the current on the rudder is only about one quarter of that on an ordinary rudder. By the help of this mechanism even the largest rudders may be handled with perfect ease. When changing direction the traps are first opened, the rudder then moved and the traps closed again, whereupon the effect is as in an ordinary rudder. The invention is also to be tried on airships.

* * * *

Great Imperial Wireless System

Arrangements are rapidly being completed to perfect the working of a great Imperial wireless system. Transmission to Canada and to South Africa is expected to be an accomplished fact in a few months. The sites for "beam" stations for service to those two countries have been handed over to the Marconi Company and are due to be completed about October. Two sites are necessary, one for transmission and the other for reception, and they are situated respectively at Bridgwater and Bodmin. The corresponding sites in South Africa and Canada are making good progress and should be completed at the same time.

As regards Australia and India, sites have been agreed between the Post Office and the Marconi Company and the legal details for possession and handing over are now being settled. These sites, which are at Grimsby and Skegness respectively, are to be opened in April or May next year. Meanwhile the great high power station at Rugby, which has a peculiar strategical value, is practically nearing completion and should be opened in the autumn.

* * * *

Telephone Development

The Postmaster General recently announced that everything possible is being done to accelerate the provision of automatic telephone equipment for Sheffield, and he hoped that the scheme would be completed in eighteen months. Sheffield would then have a model system of automatic working, with a "no-delay"

service to great centres like Nottingham, Leeds and Derby.

"What I am trying to do for Sheffield, I am trying to do as part of a general deliberate policy all over the country," he declared, and added that he believed in the development and extension of the telephone service and that it would pay for itself hand over fist. Before the summer recess he hopes to propose to Parliament a future programme of development policy for the next few years.

"I am jealous for the honour of this country in telephone matters," he stated, "and I do not like to see it standing tenth or eleventh in the list of the great telephone-using countries of the world."

* * * *

175 Million Gallons of Water Lost by Broken Pipe

The break in one of the Liverpool water supply pipes in North Wales, recently referred to in these columns, caused very little inconvenience as the repair was effected in 24 hours with only 25 million gallons loss. Unfortunately this breakage had been preceded by one near Rivington from which the loss of water was about thirteen million gallons a day, a total of 150 million gallons.

It is interesting to learn that the total quantity of water supplied to Liverpool during a recent hot week was 327,799,000 gallons, the largest on record, the average consumption being 46,828,000 gallons per day, or an excess of seven million gallons daily. In the succeeding week, which was cooler, the consumption was 320,627,000 an amount only once exceeded —namely, in the second week of June, 1922.

* * * *

New £5,000,000 Nile Dam

Scarcely has the great Sennar-Dam been opened before plans for two other similar engineering structures are advanced. It is now announced that two huge dams, estimated to cost together over £5,000,000, are to be constructed on the Nile, and that the work is to be commenced at once. As in the case of the Assuan Dam, it is probable that the contracts for these works may be placed in this country.

The main parts of the new schemes consist of the construction of an impounding dam on the White Nile at Gebel Aulia (about 28 miles up-stream from Khartum) and the building of a barrage at Nag Hamadi, on the main Nile between the Assuan Dam and the Assiout barrage.

The new dam at Gebel Aulia will be for the main part an earthen embankment, but a pierced masonry dam will be constructed across the deep water channel of the White Nile. The total length of the reservoir will be nearly 200 miles and at its designed storage level it will impound about 2,300,000 tons of water.

The new scheme will add very considerably to the irrigated lands in Egypt. The construction of the dam will also lead to a reduction of the level during the high flood period in Egypt, when great damage may be done if the peak of the flood is a high one.

The cost of the Gebel Aulia dam is estimated at £3,000,000. The Nag Hamadi barrage is estimated to cost £2,250,000. It will be used to convert about 500,000 acres from the basin to the perennial system of irrigation.

New Petrol-Electric Shunting Crane

Messrs. Craven Bros. (Manchester) Ltd. of Vauxhall Works, Reddish, Stockport, have recently built a new petrol electric shunting crane with bascule jib, for use in railway yards. The crane has been built for the 4 ft. 8½ in. gauge and can pass under an archway 15 ft. 9 in. in height. With a wheelbase of 8 ft. it can negotiate curves of 100 ft. radius. The crane, which has a lifting capacity of three tons at 22 ft. radius, can draw a load of 100 tons on the level at a speed of 250 ft. per minute. Travelling light its speed is 200 ft. per minute.

The crane is self-contained, current being generated at 220 volts D.C. by a 25 k.w. dynamo driven by direct coupling from an internal combustion engine, using either petrol or paraffin for fuel. Two 12½ h.p. motors are used, one driving each axle.

Among the advantages claimed for this type of crane are that it is always ready for action and can stand by without any fuel being consumed. It is considered particularly useful, with the aid of a lifting magnet, for handling scrap metal.

* * * *

Large Gas Engine

One of the largest gas engines in the world, and certainly the largest in this country, was recently started at the Devonshire Works of the Staveley Coal and Iron Company, near Chesterfield. The engine, which has been under construction for the past nine months, is driven by blast-furnace gases, and is connected to a 5,000 k.w. alternator.

The engine itself weighs approximately 1,000 tons, and the concrete foundation on which it stands 5,039 tons. The crank shaft and rotor weigh 185 tons. The engine house, which contains sufficient space for two more similar engines, measures 238 ft. 6 in. in length, 101 ft. 6 in. in width, and 70 ft. 6 in. in height.

The chairman of the Company stated that for the last three years they had undertaken to supply electricity to the full extent of the plant that was already at work, and any failure of that plant would have been very serious. For that reason they had avoided entering into any contracts for the supply of electricity in bulk to outside consumers. The new engine would enable them to blow out at least two blast-furnaces and still supply the same quantity of electricity as in the past.

* * * *

Winnipeg Power Plant

Comprising three turbo-generating sets, two high-pressure sets of 5,000 kilowatt capacity and a back pressure unit with an output of 1,000 kilowatts, the steam electric generating station at Winnipeg has recently been placed in commission. The station acts as a reserve plant for the city's hydro-electric system.

The turbines, which were built by Messrs. James Howden & Co. Ltd., of Glasgow, are designed for a speed of 3,600 r.p.m. Steam is supplied at a pressure of 220 lbs. per square inch. The alternators to which the turbines are coupled were supplied by Messrs. C. A. Parsons & Co. Ltd., of Newcastle-on-Tyne, and the condensing plant by Messrs. Hick, Hargreaves & Co. Ltd., of Bolton. It is interesting to note that the orders for the generating plant and condensers were placed with British firms in spite of strong competition both from America and from the Continent.

New Airship

Designed for flights to India and Australia, the new airship to be built for the British Government will shortly be commenced at Howden Aerodrome. Capable of a speed of 70 m.p.h. for a distance of 3,500 miles, the airship will carry 140 passengers and seven tons of mails.

* * * *

Pier Reconstruction at Puerto Colombia

Puerto Colombia pier, a steel structure 4,000 ft. in length, has been completely rebuilt of ferro-concrete and extended by some 300 ft. at the end, where ships come alongside. Owing to the sidings having been laid out so as to give independent access to each steamer, five or six of the biggest ships using the port can now work alongside at the same time without interfering with one another.

* * * *

Marine Engineering Development

Sir Charles Parsons is building a new turbine steamer to demonstrate the thermal efficiency of high steam pressure. This is an event of the greatest importance in marine engineering, says the "Shipbuilding and Shipping Record."

"A paper of far-reaching significance was read by Sir John Biles at the last meeting of the Institution of Naval Architects, foreshadowing this practical demonstration of high steam pressures, and Sir Charles Parsons is to be commended for his courage, which is equal to his genius as an engineer.

The new vessel is to be built for the company known as Turbine Steamers Ltd., which was formed by Sir Charles Parsons, Denny and Bros., and Capt. John Williamson, in order to construct the first commercial turbine steamers, the result being the King Edward and the Queen Alexandra, which have since continued to demonstrate successfully on the Clyde the efficiency of the Parsons' steam turbine."

The machinery will be the main feature of the new steamer, and the idea is to develop about 4,000 h.p. The turbines will follow the usual two-shaft arrangement, with gearing, but, of course, will be specially designed, as the steam pressure to be developed in the water tube boilers will be 500 lb. to 550 lb. per square inch, at a temperature of 700 degrees to 750 degrees F.

As suggested in Sir John Biles' paper, the condensers will be sub-divided, and large surfaces will be provided to give a high vacuum. The two water-tube boilers will be fitted with air pre-heaters, so that it will be seen that the installation embodies all the latest ideas advocated in the discussion on the paper referred to. It will be remembered that several boiler construction experts expressed a confidence in being able to meet Sir Charles Parsons' ideas.

Another noteworthy feature is that the steam for the auxiliary machinery will be at a reduced pressure. The auxiliary exhaust steam will be utilised for heating the feed water to about 200 degrees F., but the temperature of the feed water will be increased to about 300 degrees F. by steam tapped off from a suitable stage of the turbines. As the steam pressure is double that of any existing marine installation, the development is one of the most important in marine engineering for many years. The vessel will be of the type of the very successful Glen Sannox, built recently by Denny for the Ardrossan and Arran service on the Clyde.

Tendering for an Order

The Important Part played by Drawing Office and Template Shop

By Thomas Blench, Jr.

MANY of the inner workings of a great engineering firm appear very mysterious to those who are "not in the know," and particularly is this the case with regard to that essential department of every firm—the drawing office. The mystery is further increased by the fact that no two drawing offices are alike, even though they may be engaged in exactly the same branch of engineering. At the same time, the work of all drawing offices is based on certain important principles, and in this article it is intended to describe the work of a typical structural drawing office of a large general contracting firm.

Advertising a Contract

We are all familiar with advertisements commencing :—

> "Tenders are Hereby Invited for the Manufacture, Supply and Erection of . . . . . Copies of Tender Form and Specification will be available upon application to . . . . . "

Such advertisements are seen by contractors all over the country—or, indeed, all over the world if the job is big enough—and those who are in a position to carry out the work send for the necessary documents and drawings.

The "Specification" strictly speaking is a legally drawn-up statement regarding the material, dimensions, strength, etc., of the proposed structure. The term is also applied loosely to include the specification itself, the conditions of contract and the tender form combined. The former constitutes the legal statement of the liabilities of any contractor who may be successful in obtaining the job, whilst the latter is simply the form on which the contractor states that he will carry out the necessary work in conformity with the specification for a certain sum of money.

Varied Specifications

The specification is often interesting on account of the light it throws upon the customs of the country for which the job is intended. For a South African job, for example, clauses are inserted concerning the wages of native workers and the strict observance of their religious customs. In a recent Brazilian job the loading was stated—not in terms of rolling loads or tractor loads—but in terms of loaded mules! The conditions of contract also have their amusing side, in that they carefully enumerate every possible misfortune that may occur to the work and in every case lay the responsibility on the unfortunate contractor.

"Draughtsman" and "Designer"

The drawings are usually executed by the staff of the firm who require the job done, or, if this is not an engineering firm, by some consulting engineer. Often the drawings are incomplete and the contractor has to design portions of the work before he knows whether he is to get the job or not.

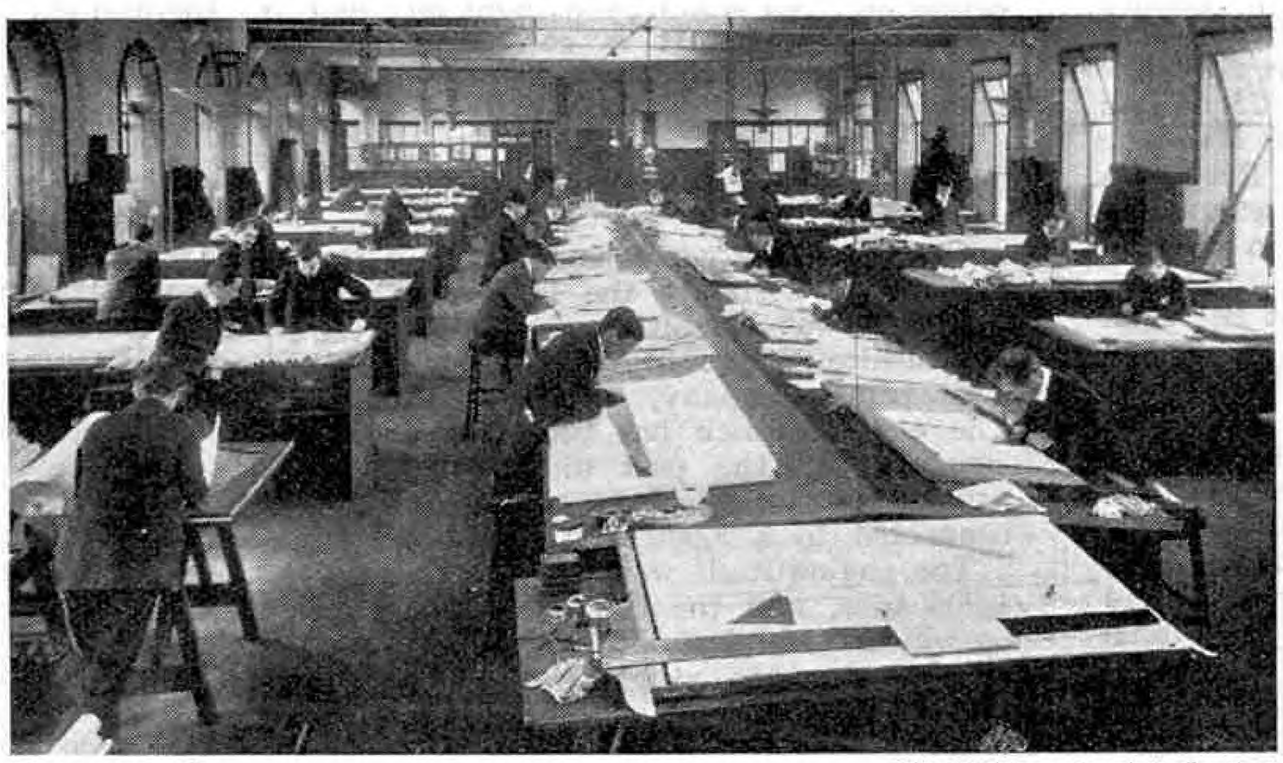


Photo courtesy [*Sir William Arrol & Co. Ltd.*

The Drawing Office of a large Engineering Works

It will not be out of place here to comment upon the terms "Draughtsman" and "Designer." A draughtsman knows the procedure of the drawing office in every detail—he can make drawings suitable for the use of the erectors or the works if he is given general drawings, and further, given the general drawings, he is able to design the details. A designer is able to do a draughtsman's work and in addition, if he is given the loading to which the proposed structure is to be subjected, he is able to get out a general scheme. The value of designers to a firm lies in the fact that they produce safe designs that are practically realisable by that particular firm.

Quantities and Weights

Let us now suppose that the drawings for, say, a complete girder bridge, have been handed in to the office and that an estimate is required. The first step is to "take out quantities" and "extend the weights."

This means that someone, probably an apprentice, is given the drawings and some specially ruled sheets on which he makes a list of the position, section, length and weight per foot of every member in the structure. By calculation he then finds the weight of all the separate main portions—main girders, cross-girders, flooring, etc. This work provides good experience for an apprentice, making him familiar with details of construction, and training him in habits of patience and strict accuracy.

The weights are afterwards checked by a draughtsman and returned if incorrect. Finally, when a correct set of figures is obtained—and if this set agrees with those that are usually stated in the specification—an estimate sheet is drawn up giving the results only

of the calculations. This estimate sheet is sent to the costing department, and if a suitable price is quoted the firm gets the job.

Drawings for the Shops

If this happens, the drawings received with the specification, etc., are once more circulated. This time it is necessary to make drawings for the use of the various shops, as the drawings so far available merely set forth what is required in such a manner that the tenderer can state a price. Often these drawings are wrong and, in terms of the specification, the contractor has to stand the loss if he is unable to find the mistakes. For example, in the drawings for a large bridge now being erected in London the writer found fully 90 per cent. of the girders to be of the wrong length! This is no uncommon occurrence, and therefore it will be seen how necessary it is for a draughtsman to check everything.

Apart from eliminating mistakes it is necessary to arrange girder work, plate work, etc., in separate drawings. Every member must bear a mark or number so that it may be identified readily and with certainty both in the making and in the erecting. Its size must be clearly stated, and notes concerning rivets, painting, testing, etc., must be made on the drawings so as to ensure that the work shall be according to specification. The draughtsman often must modify details in the design so that the structure shall be in accordance with the best practice.

Also he must be careful that members do not foul each other or rivet heads prevent members from fitting where they should. He must bear in mind how the structure is to be erected, and therefore what portions of it are to be riveted in the yard and what portions on the site. In short, a good draughtsman has to be a veritable walking encyclopædia of common sense and "tricks of the trade."

Order Sheets for Material

In order to ensure that no slips creep in and pass unnoticed until too late, every drawing is checked, usually by another draughtsman, but even this does not finish the office work. Order sheets for material are necessary and the ordered sizes must be sufficiently in excess of the finished sizes to allow for saw cuts, machining and other processes.

Shop specifications, consisting of sheets giving the mark, size (length and section), ordered size and location of all members in a drawing, must be compiled in triplicate. As a rule one carbon copy goes to the template shop and the other to the erecting department, while the office retains the original. Additional copies, required for special reasons, are blue-printed from the original. It is an indication of co-operation that, in a department consisting of machinemen, platers, rivetters, and others not so directly connected with the work in hand, the one copy kept in the foreman's office—or "box"—is usually sufficient.

A rivet and bolt list must now be made. This gives the dimensions of all the rivets and bolts required for the final erection and states the number required and the exact location of each.

Shipping Lists

A shipping list also may be required. Shipping rates vary with weight and bulk, so that it is often cheaper to send a large plate girder in two or three pieces rather than as a whole. Another point to be considered is the relative practicability of sending large members by road or rail. A shipping list enumerates the bundles or barrels of material sent and the weight of each, and it requires some skill to compile.

The final total weight should agree with the initial estimated weight and with the actual weight found by weighing the material as it leaves the yard.

Templates and Jigs

The drawing office is incomplete without a template shop. In this shop are made marking and setting "templates" and "jigs." All drawings are made full size on the floor, which is coated with lampblack and glue to show up the French chalk markings.

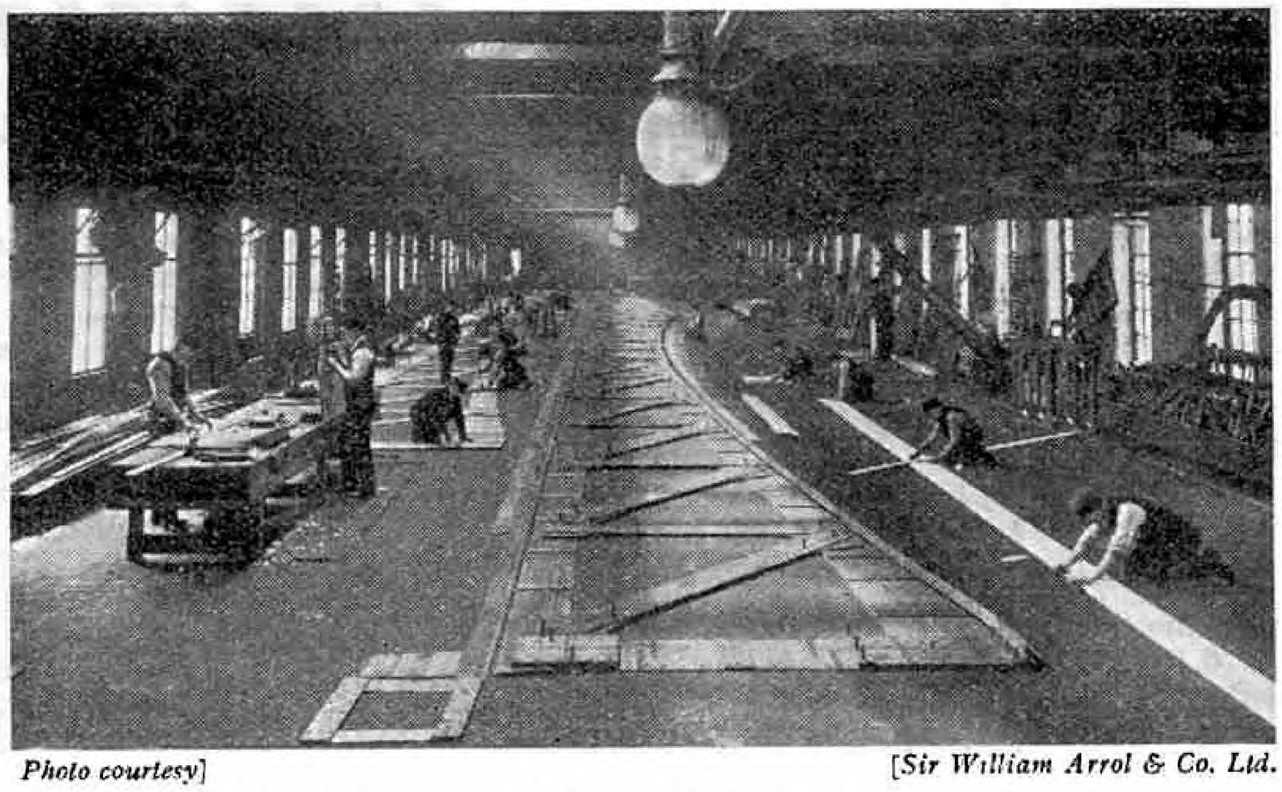


Photo courtesy [*Sir William Arrol & Co. Ltd.*

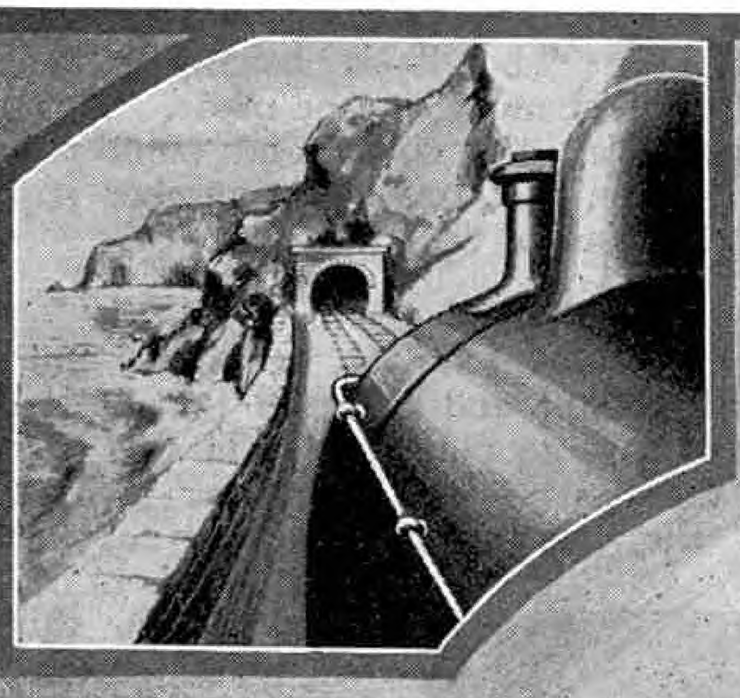
The Template Shop where the jobs are laid out to full scale

If, say, a gusset plate has to be made, a three-ply template is copied from the floor and holed correctly. Instructions are written on the plate so that the plater may know how many of these are to be reproduced in steel, and exactly what information has to be painted on the plate for the use of the erectors. The template maker has a copy of a shop specification and as he proceeds with his job he checks off the material, and his own work is checked by another man before it is issued to the works. A setting template is made of yellow pine and is intended for the smithy. It indicates how a member, for example, an angle, has to be bent or "joggled."

A jig is used in cases where a large number of members must be holed identically. It is made of teak. The holes in it are lined with metal and the driller clamps it to his job and drives his drill through the holes. The ordinary template is used for marking where holes are to go.

The templates for the steel-arch bridge in the above photograph constitute a comparatively easy task. They are assembled as shown in order to make sure that there are no discrepancies in lengths or holing. Much more difficult jobs, mentally, are those involving conical lime-kilns or curved roofs meeting, and still worse are the problems that arise when members are bent so that they cannot lie flat on the floor.

As was stated at the beginning of this article, no two drawing offices are alike, but it is hoped that the description given will provide some idea of the great importance of the structural drawing office to any great engineering firm.



Railway News of the Month

Excursions to Ireland

The Great Western Railway has recently run the first excursion to Ireland since the War. Seven hundred passengers from South Wales were conveyed to Killarney via Rosslare and the Great Southern of Ireland Railway. The latter company had a special express of 12 corridor carriages waiting for the G.W.R. steamer "*St. Andrew*" and a quick and comfortable run was made.

Seven hours were spent amid the wild grandeur of Killarney and at 6.10 p.m. the return special to Rosslare left Killarney and reached the port ahead of time. After a pleasant crossing the passengers landed at Fishguard and left at once in a special corridor express which took them home after 30 hours' continuous travelling for a rail fare of 21/–. It is announced that similar facilities will be continued weekly.

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Disposal of Surplus Locos

In 1919 and 1920 fifty locos and a large number of spare parts were built at Woolwich Arsenal in order to provide work for unemployed engineers. The locos, which were of the 2–6–0 tender type as used on the South Eastern section of the Southern Railway, have now been disposed of to various railway companies, but 38 sets of parts remain still to be sold. To date there is a total loss on the Government scheme for building locos of some £1,100,000.

The chief purchasers of the locos and parts have been the Southern Railway, Metropolitan Railway, and Great Southern Railways of Ireland. The Metropolitan incorporated the Woolwich locos into their new 2–6–4 tank class and the Irish company altered them to suit the wider gauge of their system.

* * * *

Steel Sleepers

Since 1919 a portion of the L.N.E.R. main line has been laid on steel sleepers and the results are proving very satisfactory. Each sleeper consists each of a steel channel in which are fitted inverted channel saddle pieces to which the rails, in this case of flat-bottomed type, are secured by the usual fastenings.

* * * *

Where Stations are Scarce

The longest distance between two stations in Great Britain is 32½ miles between Bridge of Orchy and Tulloch on the West Highland section of the L.N.E.R. In England, on the Southern Railway, the distance from Basingstoke to Micheldever is 10¼ miles, and thence to Winchester 8½ miles.

The Longest Electric Locomotive

An electric loco 117 ft. in length has recently been constructed by the Ford Motor Company of Detroit, U.S.A. It is claimed to be the longest single loco in the world and is capable of hauling a freight train one-and-a-half miles in length! The loco weighs 372 tons and develops 5,000 horse power.

Railway Mileage in Africa

Angola	818
Abyssinia	495
Algeria and Tunis	4,220
Belgian Congo	1,263
British East Africa	851
British Central Africa	174
German East Africa (formerly) ...	892
German Southwest Africa (formerly)	1,307
Egypt	4,894
Equatorial Africa	1,543
French Soudan	1,714
Gold Coast	194
Kamerun	193
Madagascar	402
Mauritius	134
Morocco	862
Mozambique	455
Nigeria	1,126
Reunion	79
Sierra Leone	335
Togoland	203
Union of South Africa	11,475
Total	33,629

The Oldest Coach in Service

The honour of being the oldest passenger coach in regular service to-day is claimed by a small 4-wheeled vehicle working on the Kent and East Sussex Light Railway between Robertsbridge and Headcorn. It was built in 1848 as a saloon for the use of Queen Victoria, and was shown at the 1851 Exhibition. Later it became a Royal Saloon on the L. & S.W.R. and worked between London and Portsmouth, also going to Windsor. In 1890 this royal coach came down in the world. It was sold to the Plymouth, Devonport and South Western Junction Railway, and worked between Callington and Bere Alston. It was then transferred to its present owners and is in an excellent state of preservation.

There is one door in the centre, labelled "First," and the old curved panelling and curved ends are reminiscent of stage coach days. In each end are a large plate-glass window and two smaller ones, the seven side windows being of the usual shape.

A similar coach is running on the Shropshire and Montgomeryshire Light Railway, and it is regrettable that neither of these ancient vehicles was included in the Railway Centenary proceedings.

* * * *

New York's First Train

The famous old American loco "*De Witt Clinton*," with its train of stage-coach-like cars, has been placed in the east gallery of the New York Central Railroad's great terminus at New York.

The "*De Witt Clinton*" was constructed at West Point Foundry and made its trial trip from Albany to Schenectady on 3rd August 1831, but defects in the boiler necessitated the run being completed by horses. Coke was afterwards unsuccessfully tried as a fuel, and in September 1831 a journey was made using wood. The sparks from the yellow pine burned holes in the passengers' clothing and destroyed the umbrellas with which they vainly sought protection. The driver was urged to "hurry up," and the last six miles were covered in the remarkable time of 14 minutes!

The old loco is of the 0–4–0 type, 12 ft. 10 in. in length, 8 ft. 5 in. to top of dome, and without tender, weighs 9,420 lb.

* * * *

L.M.S.R. Loco Notes

On the Northern Counties (Ireland) section of the L.M.S. many of the older passenger locos have been rebuilt with larger boilers and new cabs. They now resemble very closely the Midland section locos built at Derby and are capable of performing good work on the Portrush express services.

* * * *

Some readers of the "*M.M.*" who are now able to see Midland-pattern locos for the first time are curious about the square sheets fixed below the front end of these locos. These are shields made of thin steel plate designed to protect the bearings and motion of the loco, when it is the second or train engine and has a pilot attached in front, from the dust and grit thrown up by the first loco. They serve a similar purpose when the leading loco takes up water from the trough between the rails.

* * * *

Many L.M.S. locos are being painted in the standard Midland-red livery and the paint-shop at Crewe is very busy.

* * * *

There will soon be very few of the famous old L. & N.W. 2–4–0's left in service. The latest to be scrapped are 1527 "*Raleigh*" and 2194 "*Cambrian.*" Other locos withdrawn are two of the "*Renown*" type, 565 "*City of Carlisle,*" an "*Experiment*" and also an ex-North London Rly. Tank No. 28.

A Favourite Type of Goods Loco

Large numbers of 0–6–0 goods locos with outside frames and cranks were built for the Midland Railway between 1870 and 1874. Many of them are still serving on miscellaneous duties on the L.M.S.

During 1906 a shortage of locomotives occurred in Italy, and 50 of this type, designed by Kirtley, were purchased from the Midland by the Italian State Railways. The only alterations made by their new owners were the extension of the cab roof and the provision of Continental type buffers and drawgear. After so many years of hard work, 30 of the class are still to be found on suitable duties, and the fact is a tribute to the original designers and builders. A speed restriction of 40 m.p.h. is now imposed on these old British engines in Italy and the normal average speed is stated to be 18½ m.p.h.

The Midland Railway sent a large number of these old goods locos to France during the War. Although too small for hauling unaided the heavy troop trains, the Midland locos were very successful on lighter duties and were so simple to work that they speedily became firm favourites with their drivers. It was stated that on the undulating lines around St. Omer these old locos would run for miles without steam.

* * * *

A New Colonial "Mikado"

A new type of loco with 2–8–2 wheel arrangement has been built by the Victorian Government Railways. This line is at present of 5 ft. 3 in. gauge but in the near future it is to be changed to 4 ft. 8½ in., the standard to be adopted throughout Australia. In view of this the new "Mikado" has been built in a special manner that will entail the minimum amount of alteration when the gauge is converted.

In working order this loco weighs 119.6 tons, and has cylinders 20 in. by 26 in. and driving wheels 4 ft. 6 in. diameter. Its total length is 66 ft. 7 in. and its tractive power 26,960 lb. Among the fittings are a chime whistle of distinctive note, hopper ash-pans with discharge doors operated by compressed air, and flange lubricators for the pony-truck wheels to prevent wear of the flanges on curves.

* * * *

Three new "Mikados" are on order from Kitson and Co. Ltd., Leeds, for the Midland Railway of Western Australia, and two of similar type from Robt. Stephenson and Co. Ltd., Darlington, for the Sudan Government Railway.

* * * *

The Ottoman (Smyrna-Aidin) Railway Company (a British concern) has placed an order with Messrs. Beyer, Peacock and Co. Ltd., for a "Garratt" 2–8–0 : 0–8–2 loco.

L.N.E.R. Loco Notes

Locos of the large 4–4–0 (Great Central Section) type haul most of the fast trains between Glasgow and Edinburgh and Edinburgh and Perth. Their deep framing is being cut away to make the coupling-rods more accessible. The latest of the class to be given names are Nos. 6391, "*Wizard of the Moor*," and 6392, "*Malcolm Graeme*."

* * * *

All the famous North British "Atlantics" have now been reconstructed with superheaters and they continue to perform splendid work over the mountainous "Waverley Route" from Carlisle to Edinburgh. 4–4–0's of the former N.B.R. are now working over the Great North of Scotland section.

* * * *

On the East Coast services, a new "Pacific" of the "*Flying Scotsman*" type is No. 2550, "*Blink Bonny*."

* * * *

Southern Railway

In the middle of August a notable run was accomplished by the 10 a.m. North Cornwall express from Waterloo. In spite of a signal slack of two minutes, the 84 miles to Salisbury were covered in 86 minutes. Speeds of nearly 80 m.p.h. were attained at certain points and Salisbury was reached 1½ mins. early. The loco was one of the latest "*King Arthur*" class, and one of the same class continued the journey to Exeter, which was reached 1½ mins. before schedule time.

* * * *

A contract has been placed with the North British Locomotive Company, Glasgow, for building fifteen 4–4–0 class "L" passenger locos, for intermediate express service on the South Eastern Section.

* * * *

Since the extension of the electric services in the London area, many of the various classes of tank locos which formerly worked the suburban trains have been seen standing idle or "resting" at the engine sheds. It is probable that such displaced locos will be repaired and take the place of older types on country branches.

Rouen Station Remodelled

Owing to its low-lying position near the River Seine, the River Droite station at Rouen has been liable to sudden flooding ever since its opening in 1847. There were many other disadvantages due to the lack of space available and for some years past remodelling operations have been in progress.

The new station buildings, in reinforced concrete, are very striking, the ornate facade of the grand hall being surmounted by a lofty clock tower. Access from one side of the station to the other is now provided by three footbridges, also in reinforced concrete. The central footbridge affords sufficient width for a series of waiting-rooms, and all three are connected by longitudinal galleries linking up every part of the station.

In order to extend the platforms and provide sufficient accommodation for modern expresses, the entrances to the two approach tunnels have had to be set back distances of 80 metres and 100 metres respectively, thus increasing the total length of the station from 230 to 410 metres. In place of two narrow platforms there are four of reasonable width. Additional tracks and sidings have been put in, and the station is now worthy of the fine city of Rouen.

* * * *

British Locos for South America

Twenty 3-cylinder main line express locos of the "Pacific" type are to be built in England for the Buenos Aires Great Southern Railway, the gauge of which is 5 ft. 6 in. The new locos will be fitted with superheaters and other modern appliances. The contract has been placed with the Vulcan Foundry Ltd., Newton-le-Willows, Lancashire, which firm is also to build five additional locos for the Tanganyika territory of Africa, this order having been placed by the Crown Agents for the Colonies. These locos are designed for the metre gauge, and are to be of the 2–8–2 or "Mikado" type which is becoming increasingly popular.

* * * *

A Fast Run

On 31st July the 3.45 p.m. express Swindon to Paddington, which is booked to run the 77.3 miles in 75 minutes (61.8 miles per hour) left Swindon 7 mins. late. The express consisted of nine large coaches weighing 300 tons, and was drawn by the 4-cylinder 4–6–0 loco No. 4051, "*Princess Helena*." It passed Reading 4 mins. late and arrived at Paddington on time. The overall speed was thus 68.24 m.p.h. The journey reflects great credit on the driver, W. Wright, of Old Oak Common Shed, and also on the operating department in that there was a clear road for the train, which was somewhat remarkable for the Friday before Bank Holiday.



This photograph, which won First Prize (Section B) in our 13th Overseas Photographic Competition, was submitted by our reader, Robert Bandiera, of Florence, Italy. It shows the Milan-Rome Express in the Central Station, Rome. The loco, which is one of the latest Italian types, is fitted with electric headlamps.



Electricity

XIX. LORD KELVIN AND THE SUBMARINE TELEGRAPH

IN our article on land telegraphy we saw that on long lines it was necessary to employ a relay at the receiving station to operate the sounder or inker, owing to the weakness of the received currents. In the case of a submarine cable the received currents are so weak that they are unable to operate even the most sensitive relay of the ordinary land type, and special receiving apparatus had to be devised.

The most important work in this connection was carried out by the great British physicist William Thomson, afterwards Lord Kelvin.

Lord Kelvin was born on 26th June 1824, at Belfast, where his father was a mathematical teacher at the Royal Academical Institution. In 1832 his father became Professor of Mathematics at the University of Glasgow, and there the boy matriculated two years later. In 1841 he entered Cambridge University where he was very successful in his studies. Subsequently he worked for a year in Paris with Regnault, a scientist who made the properties of steam his special study.

In 1846 Lord Kelvin accepted the Chair of Natural Philosophy at Glasgow University and remained in that position for 53 years. It was there that he made all his researches and discoveries and invented innumerable machines and instruments for use in all phases of life.

Lord Kelvin's researches covered an enormously wide field, but it is in connection with his work in electricity that he is most universally famous. There is scarcely any type of electrical measuring instrument that he did not invent. His instruments measure currents from the strength of those in wireless receiving aerials to those that drive electric trains; his voltmeters measure from a minute fraction of one volt to 100,000 volts.

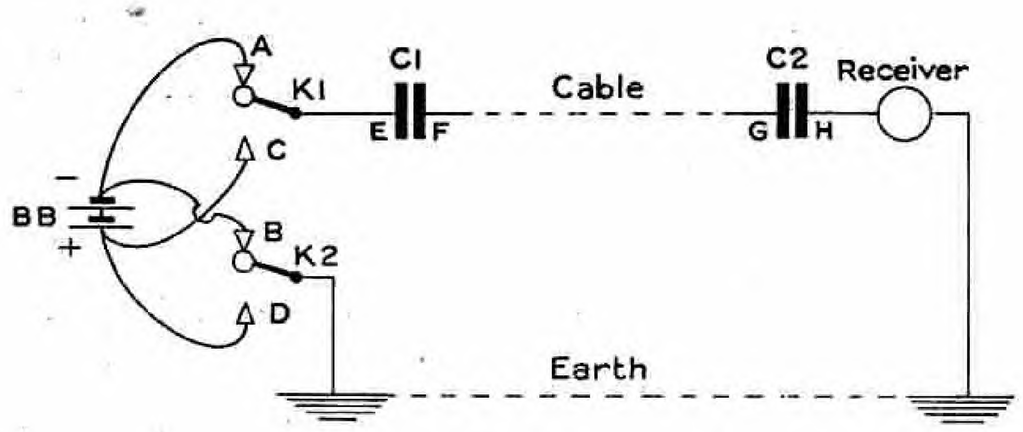


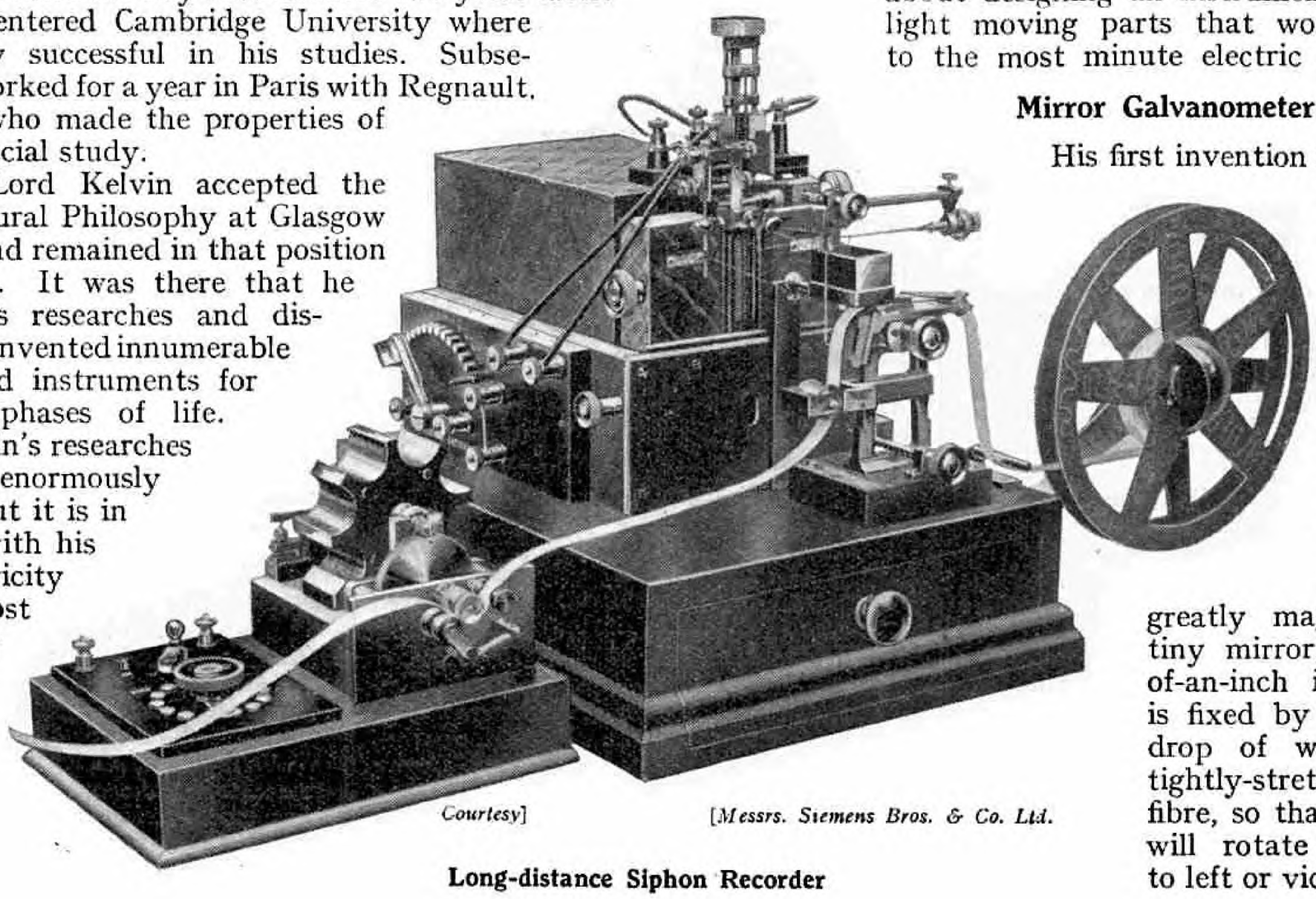
Fig. 1

Signalling through Cables

In 1855 he investigated the theory of signalling through submarine cables and came to the conclusion that the maximum rate of signalling would be inversely proportional to the square of the length of the cable. This was denied by many scientists, and those few who admitted that it might be correct stated positively that, in consequence, submarine telegraphy would be impossible. Lord Kelvin was led to anticipate very weak fluctuations of currents at the receiving end and accordingly set about designing an instrument with very light moving parts that would respond to the most minute electric currents.

Mirror Galvanometer

His first invention for receiving cable signals was the mirror galvanometer, by means of which the effect of the impulses received through the cable is greatly magnified. A tiny mirror, a quarter-of-an-inch in diameter, is fixed by means of a drop of wax upon a tightly-stretched silk fibre, so that the mirror will rotate from right to left or vice versa with

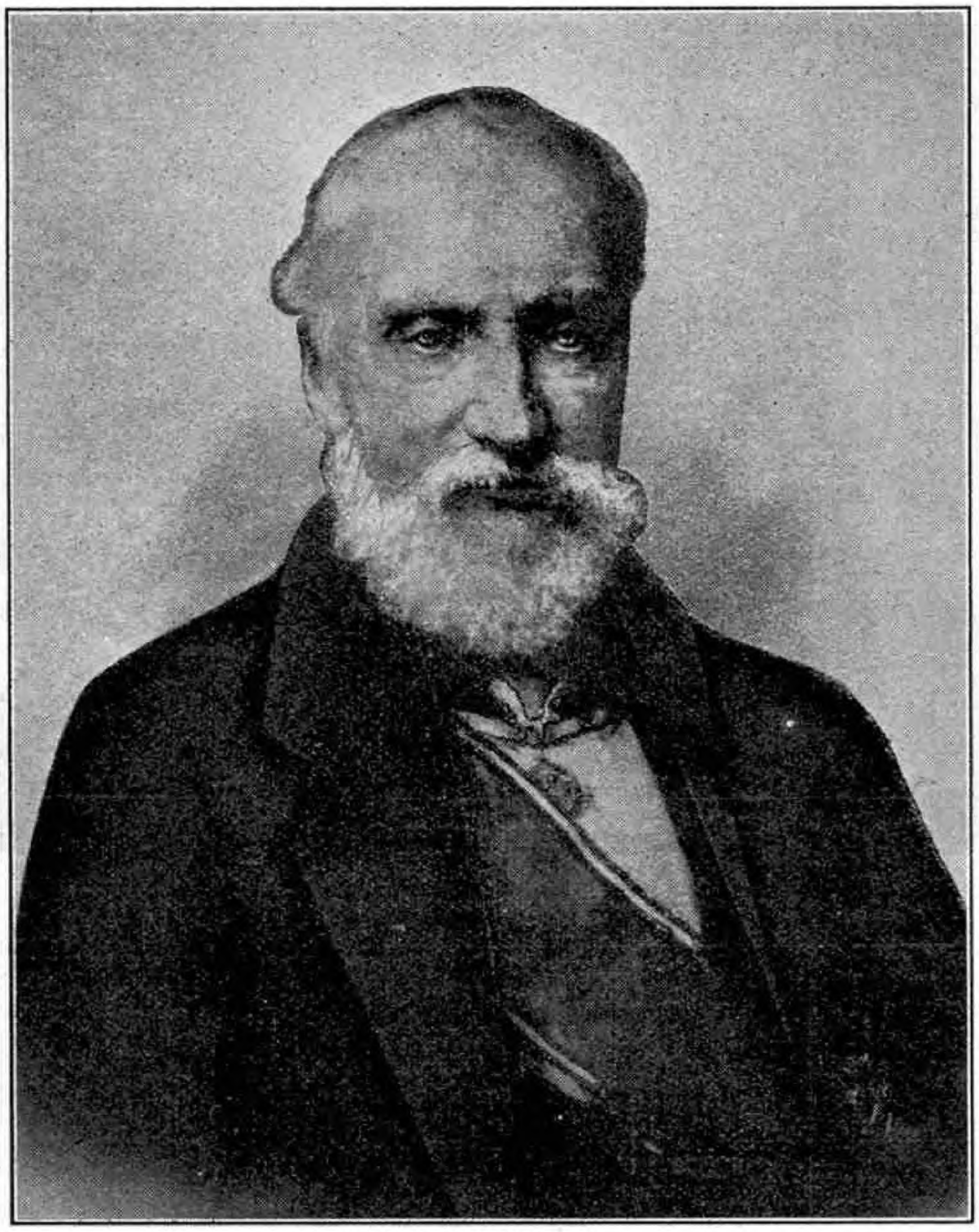


Courtesy [*Messrs. Siemens Bros. & Co. Ltd.*

Long-distance Siphon Recorder

the slightest impulse. To the back of the mirror is attached a sensitive magnetic needle upon which the currents received through the cable act. The mirror moves in one direction or the other according to the polarity of the impulses affecting the needle. A ray of light is focussed upon the mirror and reflected upon a white surface a few feet away, so that a movement of the mirror too small for the eye to detect is magnified into a wide fluctuation of the light beam. The cable operator learned to translate these vibrations into dots and dashes, and for several years after the first deep sea cables were laid this was the only means of reading their messages.

The mirror galvanometer has several disadvantages, among them that of making no permanent record of messages, and accordingly, in 1870, Lord Kelvin invented the siphon recorder, which is still in use, although increased in sensitiveness and efficiency by subsequent improvements. By means of the siphon recorder the actual shape of the electric waves or impulses sent over the cable is made visible.



Lord Kelvin

The Siphon Recorder

The underlying principle of the siphon recorder is the same as that of its predecessor, the galvanometer. Instead of a mirror, however, the silken fibres sustain the weight of a tiny bent glass tube, not much thicker than a hair. One end of this tube is immersed in a vessel of extremely fluid ink, while the other end rests with the lightest possible pressure upon the strip of paper passing over rollers. As the paper strip travels along under the little tube, a hair-line ink mark is made, the ink being drawn from the ink vessel through the tube by siphonic action.

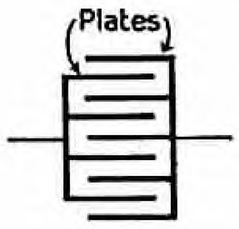


Fig. 2

When no current is being sent through the cable the line traced by the siphon is a straight one down the centre of the paper strip, except for deflections due to earth currents and other magnetic and electric disturbances. When a positive or "dot" impulse arrives it swings the galvanometer to the left, so that the siphon traces a curve above the middle or zero line. When a negative or "dash" impulse comes through, the curve is made below the line.

Both these instruments, besides being still used extensively in submarine telegraphy, are invaluable to the electrician in his laboratory to enable him to measure minute currents or minute fluctuations of current.

A Professional Jubilee

On the occasion of Lord Kelvin's jubilee of professorship at Glasgow great celebrations were held, over 2,500 guests being received in the university buildings. The festivities lasted three days, and never before had there been such an assembly of rank and science. Lord Kelvin was probably the most important scientist of the 19th century, and yet, in spite of his knowledge and intellect, or perhaps because of it, he never tired of explaining the simplest scientific fact to the elementary student, and nothing gave him greater pleasure than to acknowledge the efforts of the humblest scientific worker.

In 1899 Lord Kelvin resigned professorship and devoted himself to the study of the wave theory of light, and only a few months before his death, on 17th December, 1907, he delivered a momentous address to the British Association on the electronic theory of matter.

Cable Working

Turning now to the actual working of cables, we find that while to a certain extent the circuit used for duplex working is similar to the bridge method already described in connection with land telegraphy (*Meccano Magazine*, May 1925, p. 240, Fig. 3), the simplex circuit is entirely different from any other telegraph system. Both circuits also are unique in that no current is actually passed through the cable!

The working of a submarine cable differs in one important respect from that of a land telegraph line. The cable in its insulated coatings acts like a Leyden jar of enormous capacity; in other words it accumulates electricity and does not quickly part with it as does a bare overhead wire. The cable must be to some extent charged and discharged for every separate signal and the result is that the working speed is slow compared with land working, although the difference has been partially overcome by the employment of extremely

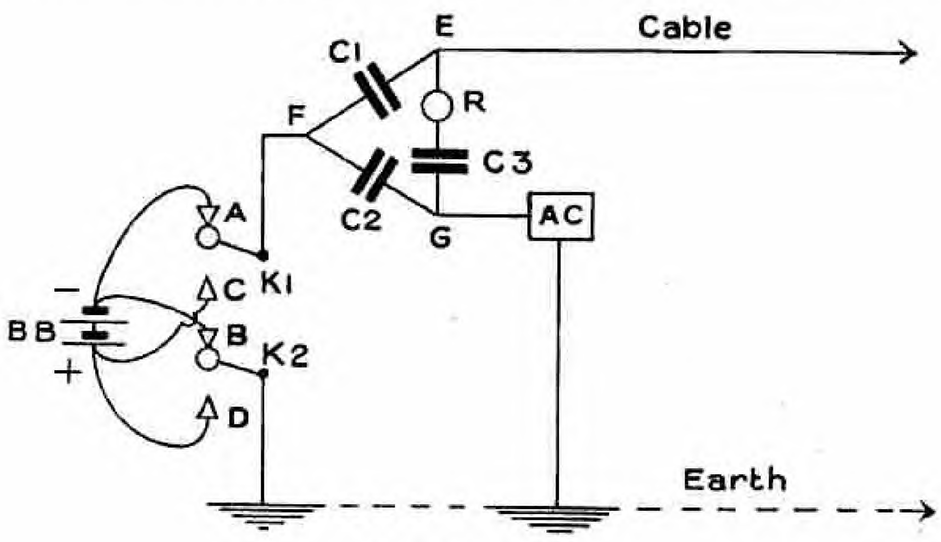


Fig. 3

sensitive receiving apparatus. This apparatus, which has done much to make submarine telegraphy successful, will be described in detail shortly.

Simplex Circuit

The circuit in Fig. 1 shows the connections for simplex working and that in Fig. 3 for duplex working where it will be noticed that use is made of several condensers.

The working of a condenser was briefly described in the article in this series in the "*M.M.*" for May, 1924. All readers who are interested in wireless know that a condenser consists of two sets of metal plates insulated from one another but arranged so that the plates of one set come between the plates of the other set as shown in Fig. 2. The only property of a condenser with which we are concerned here is that if one set of plates is given a positive charge, a negative charge is induced in the other set.

The working of the Fig. 1 circuit is as follows. The two key arms K1 and K2 normally rest against the back stops A and B, which are connected to the "—" terminal of the battery BB. K1 is joined to the plates E of the condenser C1, while K2 is joined to earth. The stops C and D are connected to the "+" terminal of the battery BB, and the cable is wired in the circuit as shown, C2 being a condenser at the receiving station. When it is desired to send a dot over the line, the key K1 is pressed, while key K2 is employed for a dash.

Suppose K1 is pressed on to C. This will have the effect of connecting the battery BB between C1 and earth through K1, C, BB, B and K2, with the positive terminal connected to E. This results in giving E a positive charge, which will induce a negative charge in F. This again will result in a positive charge forming on plates G of condenser C2, which will induce a negative charge in H. This will leak to earth through the receiver, which will record its passage.

When K2 is pressed the same effect results except that E will be charged negatively, resulting in H ultimately receiving a positive charge whose passage the receiver will interpret as a current flowing in the opposite direction.

Simultaneous Messages in Opposite Directions

The duplex circuit enables messages to be sent in opposite directions at the same time and works as follows. In Fig. 3, C1, C2 and C3 are three condensers connected as shown, and AC is an "artificial cable" fulfilling a similar function to the "artificial line" used in land telegraphy. The values of the condensers C2 and C1 are so chosen that they bear the same ratio to one another as the artificial cable AC bears to the real cable. The arrangement of the keys and battery is the same as for simplex working.

When K1 is pressed, the positive charge from the battery BB divides at F, part going to C1 and part to C2. If C1 is to C2 as the cable is to AC, then no difference of potential will occur between the points E and G, so that no current will flow through the receiver R and condenser C3. The negative charge induced in C2 will leak away to earth via AC, and that induced in C1 will pass through the cable.

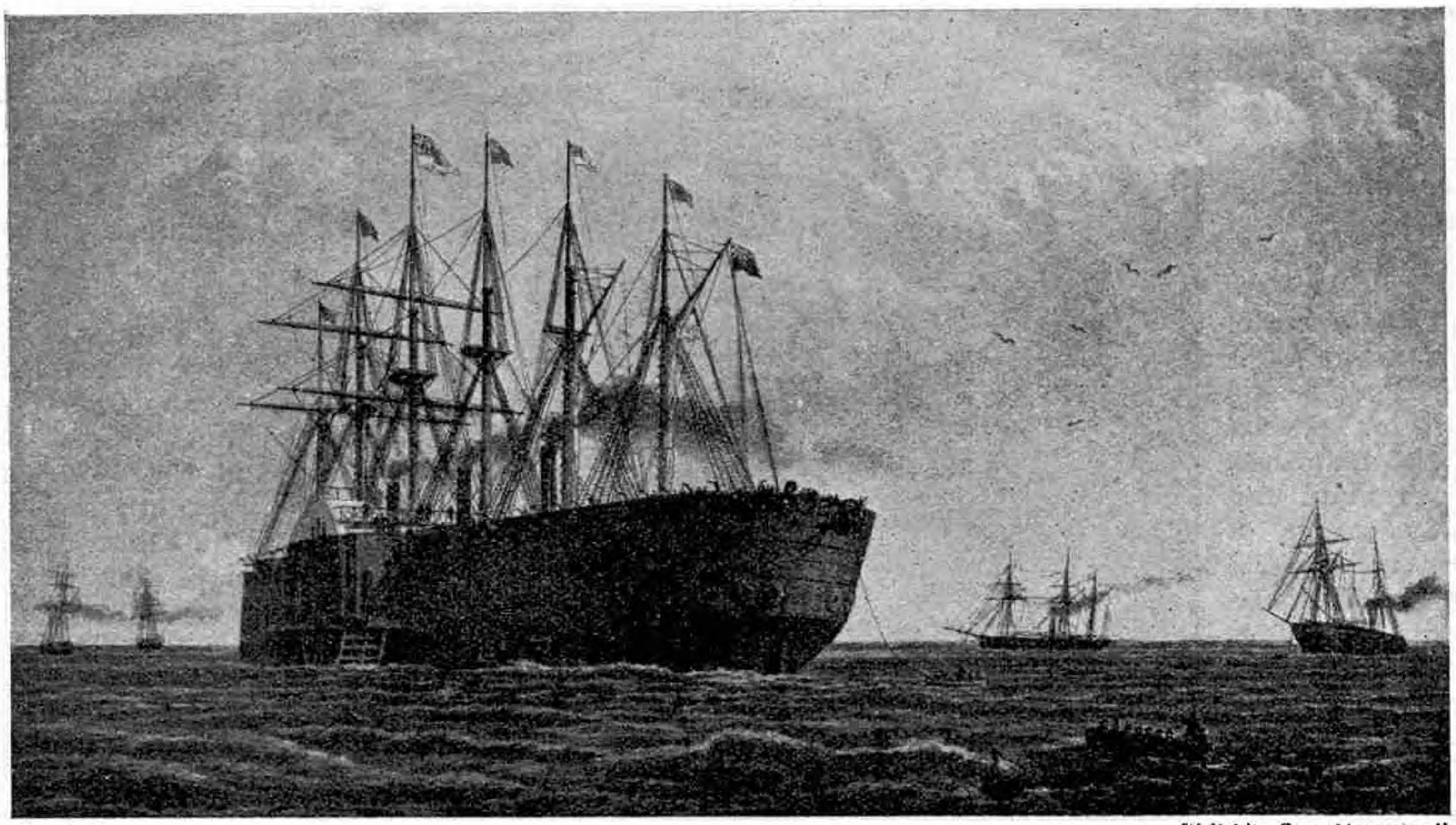
Supposing now that the charge is arriving at this station through the cable. At E it will divide, resulting in a positive charge on both C1 and C3. But in charging C3 the current has passed through the receiver R and will be recorded there by the inker. The charge induced in C1 will leak away to earth via the keys K1 and K2, and that in C3 via the artificial cable AC. Thus an incoming charge operates the receiver and an outgoing one does not. Whether a dash or a dot is recorded at the distant end depends merely upon whether K1 or K2 is the key pressed. It will thus be seen that no current ever actually flows into or out of the cable in either system of working!

Lord Kelvin once graphically expressed the minuteness of the cable's electrical requirements when he said: "All the current necessary to operate an Atlantic cable can be generated in a lady's thimble!" This statement was, of course, challenged at once, but Lord Kelvin succeeded in actually transmitting a signal across the Atlantic by means of a current generated in so small a compass.

Handicap to High Speeds

The chief handicap to high-speed transmission of messages over submarine cables is the attenuation and distortion of the electrical impulses or waves in their passage through the long conductor. The result is the crowding of the impulses one upon another with a consequent jumbling and confusion of signals.

The current starts off on its trans-oceanic travels in a wave which at first is sharply defined but which soon flattens out and lags, from a combination of electric and magnetic causes, until at the receiving end it has lost its strength and shape and requires an appreciable time to register its effect upon even the most delicate recording instrument. A single impulse or wave represents but a single dot or dash in the Morse code, and the average length of letters in the abbreviated Continental Morse used in cable operation is about four dots and dashes per letter. Consequently, whenever a second wave follows the first through the cable without an interval between the two to allow the first wave to register on the receiving instrument, the front of the second wave overtakes the tail of the first wave and further changes its shape. The second signal has begun to register before the first has completed its course, and a third wave may follow and mingle its impulse with the first and second.



Courtesy ["*White Star Magazine.*"

The "*Great Eastern*" laying the Atlantic Cable

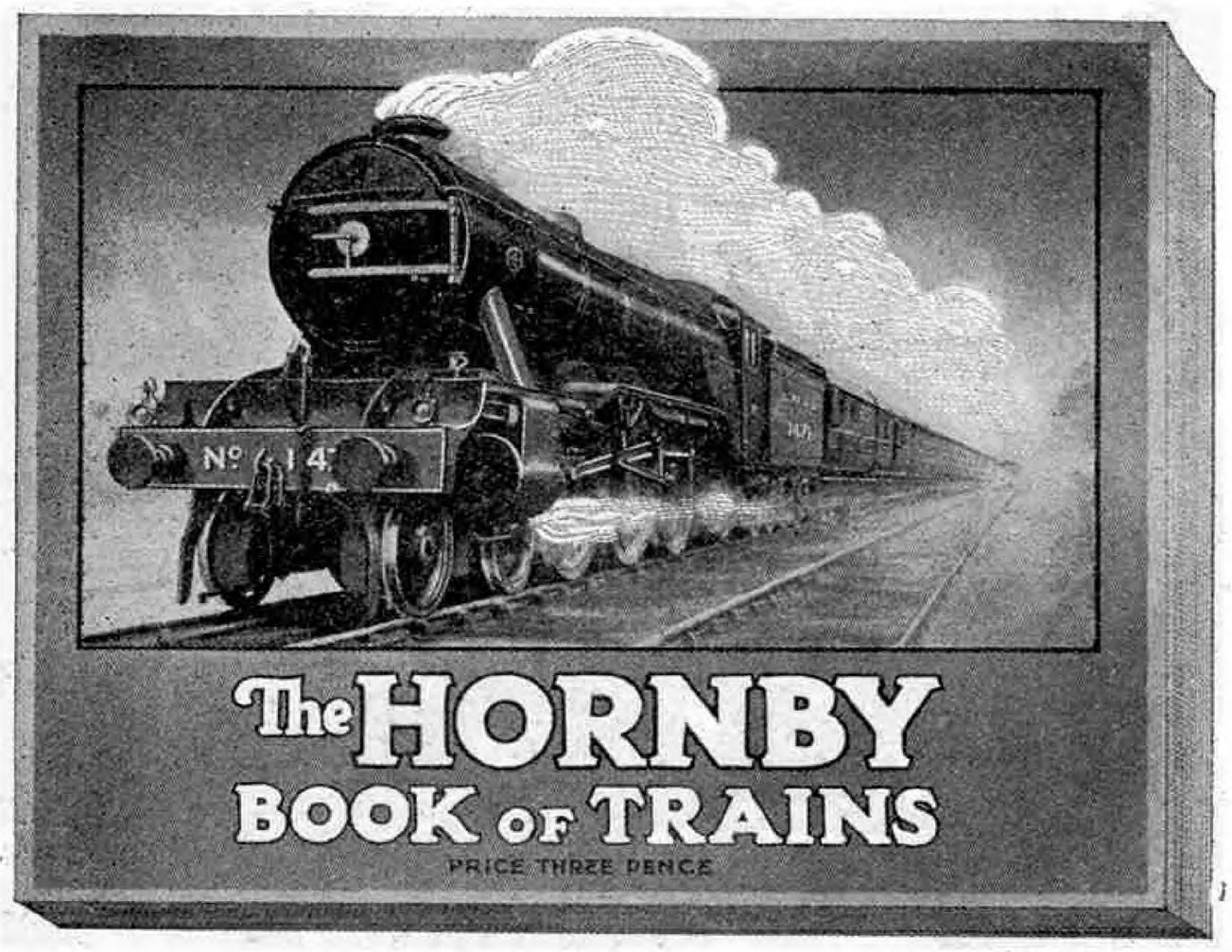
Permalloy

In order to overcome this serious drawback, an entirely new type of cable, in which the copper conductor is wrapped in a thin tape of a new metallic alloy known as "Permalloy," has been recently invented by the engineers of the Western Union Telegraph and Cable Company, to whom we are indebted for much useful information.

Permalloy is an alloy of nickel and iron in the proportion of 78½ per cent. nickel and 21½ per cent. iron, annealed and heat-treated in a particular way, and is valuable in that its magnetic permeability is many times that of any other known substance. The new cable is exactly like a standard deep sea cable except that around the copper conductor is wound a thin tape of permalloy an eighth of an inch wide and 6/1000 of an inch thick.

The first of these new cables was laid last spring for the Western Union between New York and the Azores and is operated at a speed of 300 words per minute by means of automatic apparatus. Next spring it is hoped to lay a cable of this type between London and New York via Newfoundland, this cable being expected to permit 500 words per minute to be transmitted.

The economic importance of this increased speed is obvious.



Have You Ordered Your Copy?

As already announced, we have in active preparation a special publication entitled "*The Hornby Book of Trains.*" This will be a splendid production in every way, and we are sparing no effort to make the publication worthy of the name it bears. It will consist of 40 pages (11″ × 8¼″) of special art paper. The cover, illustrated above, will be a magnificent reproduction in colour of the L.N.E.R. "*Flying Scotsman*" at speed. It is well worth framing.

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The Development of Iron Rails.
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The price of the book is 3d. (post free), which may be sent in stamps. There is no reduction if more than one copy is ordered. Orders will not be acknowledged.

Published this Month

We hope to have "*The Hornby Book of Trains*" ready for delivery about the 9th of this month. Orders will be entered in the rotation received and the book will be dispatched as soon as supplies are received from our printers.

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There will be a special edition of "*The Hornby Book of Trains*" for Overseas readers, and copies have already been dispatched to fill orders received from Overseas. Readers overseas who require copies should address their orders to our Overseas agencies as below. Readers living in countries other than those mentioned should order from Meccano Ltd., Binns Road, Liverpool, and send a postal order for 6d. with their order. The price for all orders from outside the United Kingdom is 6d.

AUSTRALIA : Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.

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SOUTH AFRICA : Mr. A. E. Harris (P.O. Box 1199), Textile House, Von Brandis Street, Johannesburg.

OUR MAIL BAG



In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

L. Haddock (Ipswich).—"I go my rounds nightly, When no one's about, And when duty's finished I turn the lights out; Then ride slowly homeward, Very near dead, Eat a nice breakfast, Then turn into bed!" Your friend the watchman who is continually reeling off poetry must be a decidedly interesting companion. It must be rather exciting waiting for his next poetical outbreak! No doubt making up these little poems whiles away the long hours when he is alone on night duty.

G. Carpenter (Camborne).—You really ought to have written to us long ago considering you have been a regular reader of the "*M.M.*" for two years. We shall expect you to write often in future to make up for lost time. We were delighted to hear that your science master likes the "*M.M.*" and finds our articles useful. We receive many appreciative letters from schoolmasters and these good opinions are very encouraging to us. If possible we shall use your short description of the model of an "Expanding Man." We have not heard of this model before.

C. C. McCallum (Auchincruive, Nr. Ayr).—You certainly lost no time in fixing up your aerial and we are glad that you were so pleased with our crystal receiver. You seem to have been unlucky on that particular day in regard to outside "noises." "The railway was never so busy in all its life as on that day. Trains shunted, excursions raced and locos whistled. On the road at the back of us all the motor cars in Britain seemed to roar past with gears grinding and hooters blowing. All this because I wanted absolute silence!" In spite of all your troubles you seem to have had a great day to judge by your concluding sentences : "I went to bed that night having thoroughly enjoyed the concert and very pleased with 'RS.1.' I thought what a great life Meccano life was."

W. P. Hills (Penzance).—We quite agree with you that all the credit for railways does not belong to George Stephenson. Trevithick was certainly "The Father of the Locomotive" and we think you will be interested in our story of his life appearing elsewhere in this issue. In "The Men Who Gave us Railways" we have included some of the less known railway pioneers, who have been overshadowed to some extent by the two Stephensons.

G. Russell (Blackrock, Co. Dublin).—"Being attracted by the cover of the Xmas number of the Meccano Magazine I bought it and have continued to do so ever since. I can honestly say that there is no paper to whose advent I look forward so eagerly as the "*M.M.*" Our coloured covers are costly to produce but we are more than repaid when we know that regular readers are attracted by them. We are rather doubtful about a chess column, as we are afraid it would appeal only to a very small proportion of our readers.

J. M. Russell (Southport).—Your visit to the lighthouse at Aberdeen must have been very interesting and no doubt you will be glad to hear that we have in preparation a series of particularly interesting articles on the great lighthouses of the world. The number of our readers interested in Esperanto is growing and we are considering devoting a small amount of space every month to this interesting language.

V. Bishop (Sydney).—You appear to have had an exciting time when you took your clockwork motor to pieces! It is always a tricky business replacing a powerful spring. Next time you make a big model send us a photograph of it and a few details.

N. Fraser (North Canterbury, N.Z.)—We were very interested to hear of the neighbour who comes in twice a week and always enquires whether "The Magazine" has arrived. It was also pleasant to hear that your father turns to the Magazine after he has finished the daily paper. You seem to be having a good many bicycle accidents. Don't you think you should be a little more careful?

W. O'Mahony (Drumcondra, Dublin).—"Your stamp articles are great. I have read stamp articles in other journals, but for sheer fascination the 'Stamp Tour Round the World' beats the band!" The writer of our stamp articles was so delighted when he read your opinion that he couldn't do any more work the rest of the day!



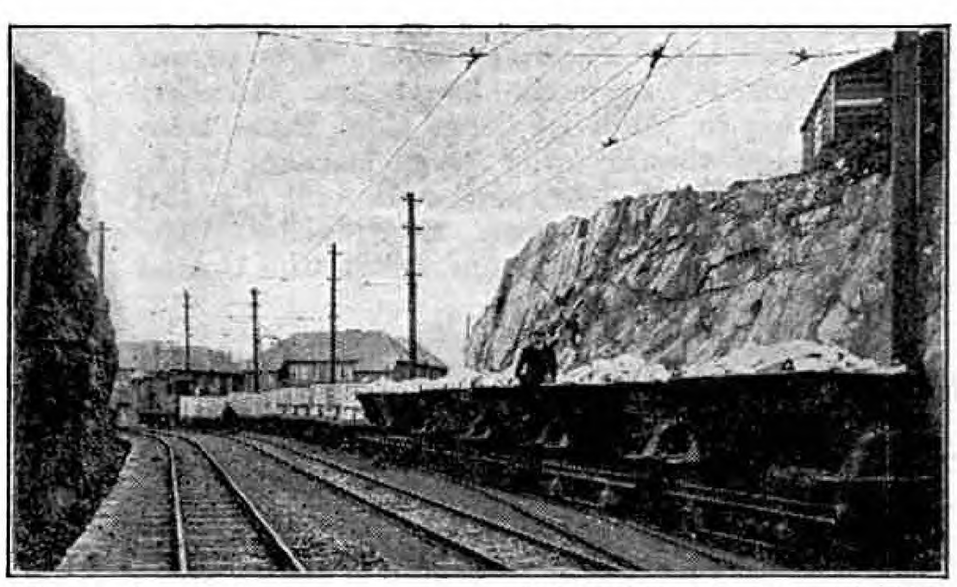
In the following article we commence the story of the interesting metal Aluminium. This metal came rapidly into prominence during the Great War on account of its lightness combined with high tensile strength, and it has proved itself one of the most valuable and versatile of all the non-ferrous metals. Indeed, the extent to which this silvery metal is used to-day throughout the world is probably not generally realised.

This month we deal with the history of aluminium and the method by which it is produced. Next month we shall describe the most important applications of the metal and its alloys, and show to what a considerable extent it has superseded copper, brass and even steel.

ALUMINIUM is more abundant in the earth's crust than any other metallic element but strangely enough its existence as a metal was not proved until comparatively recent years. In this respect it presents a great contrast to the metals we have already dealt with in this series of articles—iron, copper and lead.

The name aluminium is derived from the Latin word "*alumen*." The historian Pliny describes various coloured salts called alumen, but the name appears to have been applied to almost any salt that had an astringent taste.

Some centuries after Pliny we find references to a form of alumen known as "rock alum," and this was what we know to-day simply as alum. About the year 1700 the idea began to develop that the base of alum was an individual substance of the nature of an alkaline earth. Some 60 years later the theory was advanced that the unknown substance was of a metallic nature and chemists began to experiment with the object of isolating the metal.



Courtesy] [*The British Aluminium Co. Ltd.*

Aluminium Slabs at Kinlochleven awaiting Shipment

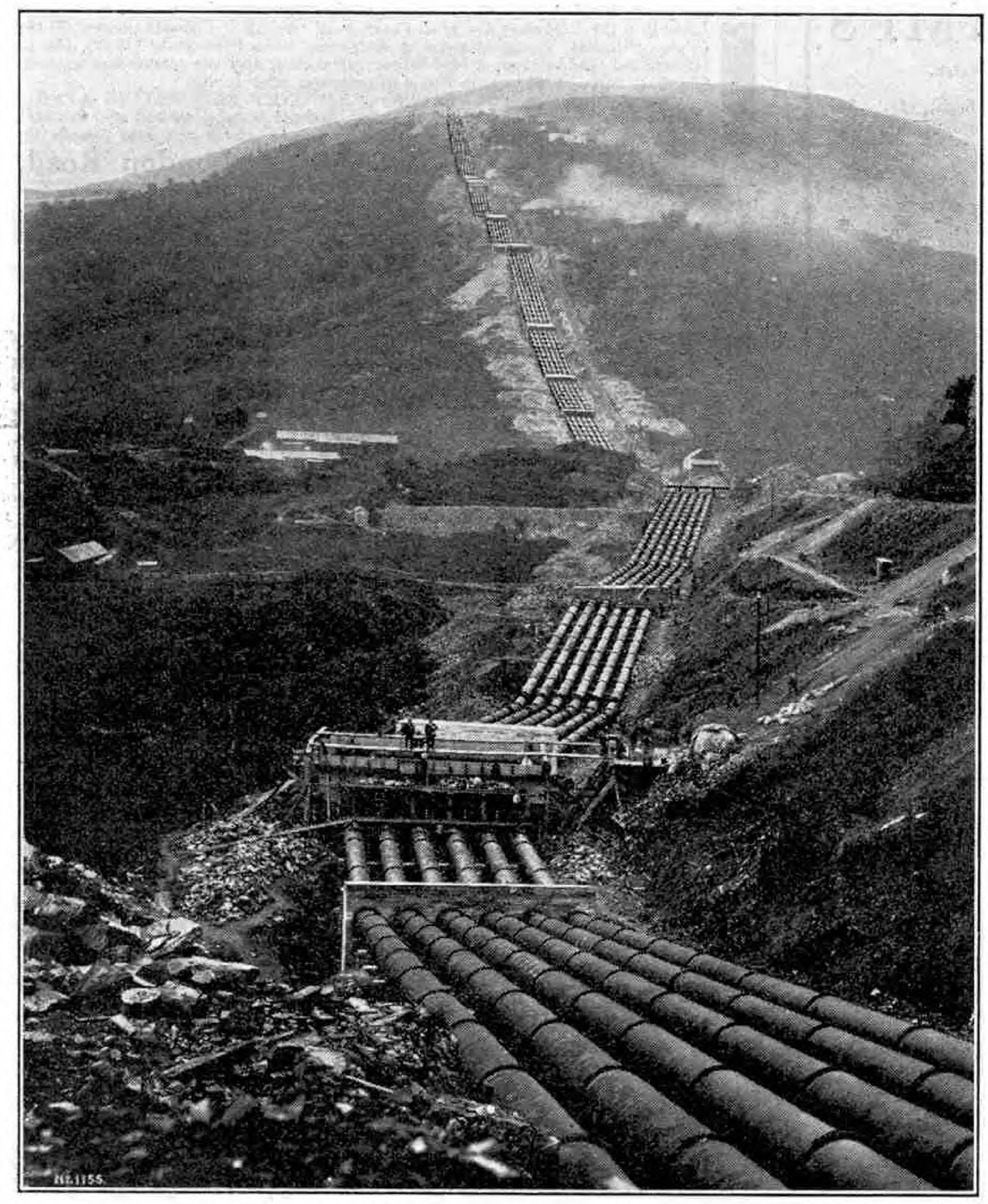
Aluminium First Isolated

In 1807 Sir Humphrey Davy succeeded in isolating electrolytically the metals potassium and sodium, and a couple of years later he attempted the decomposition of alumina, the oxide of aluminium. He failed to isolate the metal, but he succeeded in obtaining evidence of the electrolytic formation of an iron-aluminium alloy. In 1827 Frederick Wöhler, Professor of Chemistry at Göttingen University, succeeded in obtaining aluminium in the form of a grey powder and 18 years later he produced the first globules of metallic aluminium.

H. St. Claire Deville, Professor of Chemistry at the Ecole Normale, Paris, working independently in 1854 on the same lines as Wöhler, also produced globules of aluminium, and at once set to work to devise a process for the commercial production of the metal. He succeeded in developing a process that brought down the price of aluminium from £23 to 28/- per pound, but the process was unsatisfactory in many respects and very soon he turned his attention to the

production of the metal by electrical methods. He succeeded in producing pure aluminium by reducing aluminium chloride in the electric arc.

At that time the dynamo had not been invented and the only source of electric current was the primary cell, which made the process far too expensive to be of any commercial value. The introduction of the dynamo removed this difficulty, however, and from 1855 to the present day a steady advance has been made in the electrolytic production of the metal on a commercial scale.



Kinlochleven, looking towards the Penstock Chamber

Characteristics of the Metal

Aluminium is a white metal having a slight bluish tinge that gives it some resemblance to silver. It is the lightest of all metals in common use, being only half the weight of iron and one-third the weight of copper. Its lightness for a given strength is one of its most valuable features and has resulted in its application in almost every industry. It may be cast, rolled, drawn or extruded more easily than most metals, and in malleability it is little inferior to gold.

Aluminium is not found in nature in a free state, but its compounds exist almost all over the world, being the base of clays, loams, etc., and of various rocks and minerals. Commercial ores of aluminium, however, are comparatively scarce.

Aluminium Minerals

The only commercial source of aluminium to-day is "*bauxite*," an earthy mineral varying in colour from white to red and occurring in considerable quantities in Ireland, France, Roumania, the United States, British Guiana, India and the Gold Coast. This mineral owes its name to its discovery by Berthier at Baux, near Arles, in France.

Another aluminium mineral known as "*cryolite*" is used in the manufacture of opalescent glass and of enamel for ironware, and also in the manufacture of white Portland cement. It was formerly used as an ore of aluminium but is now only employed as a molten solvent in the production of the metal from bauxite. Extensive beds of cryolite exist in Greenland, from where 10,000 tons of the mineral are shipped annually. Natural cryolite is not now used so much as was formerly the case, synthetic processes for its production having been brought to considerable perfection. Cryolite is a pale grey or white mineral having a pearly lustrous appearance, and its name is derived from two Greek words, "kryos," cold, and "lithos," stone.

An interesting aluminium mineral is "kaolin" or china clay. Kaolin contains about 24.4 per cent. of aluminium, but no really satisfactory process has yet been evolved for the production of the metal from it. Corundum, the chief natural oxide of aluminium, contains over 50 per cent. of pure metal and at one time was used in the production of aluminium. It is no longer used for this purpose, however, because its extreme hardness renders it difficult to work and at the same time makes it of more commercial value when used as an abrasive. Corundum is white when pure but is almost always found coloured, and its rarer varieties are used as gems, including the sapphire, ruby, "oriental" emerald and "oriental" topaz.

Aluminium from Bauxite

The first step in the production of aluminium from bauxite consists of crushing the ore in a stone-breaker to the size of small nuts. After crushing, the ore is calcined at a temperature not exceeding 400° C., which has the effect of destroying any organic matter present and of eliminating moisture. This calcining process is generally carried out in a rotary kiln lined with some refractory material. The ore is fed in at the upper end of the kiln and, as the latter revolves, the ore gradually works down to the discharge end, on its journey coming in contact with a column of hot gas produced from powdered coal. The calcined ore is discharged continuously at the lower end of the kiln, where arrangements are made to collect it.

(*Continued on page* 527)

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(See also pages 514 and 515).

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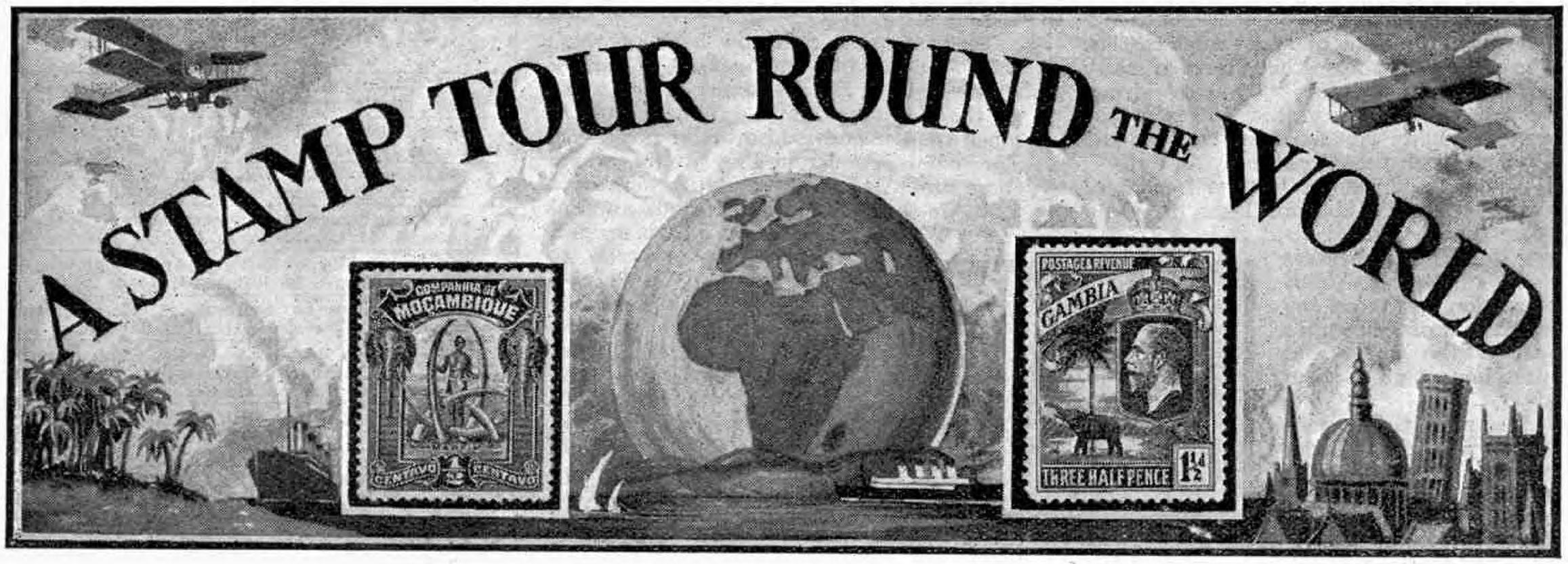
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XIII. WESTERN ASIA

FROM the French Somali Coast we fly in a northerly direction over the Red Sea and the Arabian desert until we arrive at that part of Mesopotamia around the Euphrates and the Tigris often called Iraq or Irak. Here we visit the Sunni Mosque at Muadhdham (1923, ½a. and 2r., illustrated), the Shai Mosque at Kadhimain (6a. and 10r.) and the magnificent ruins of Ctesiphon (3a., illustrated).



The series of stamps to which these belong was designed by Miss Cheesman and Mrs. Garbett, who made a tour of the country for the special purpose of finding suitable subjects for the stamps. They were engraved and printed by Messrs. Bradbury, Wilkinson and Co. of London, on paper watermarked with the customary multiple script CA and Crown, and perforated 14 by a single line machine.

The Arch of Ctesiphon

Mesopotamia was part of the Turkish Empire until it was captured by British and Indian troops during the war. The capital, Baghdad, was captured on 11th March 1917. The country is now an Arab kingdom under British Protection.



Ctesiphon was a large village on the left bank of the Tigris about 25 miles south of Baghdad. The only remains now visible are the ruins of the gigantic building called Takhti Khesra, which means " throne of Khosrau " or of Chosroes I., the name of the man who built it in A.D. 550. The arch, which is well shown on the stamp, was 95 ft. in height, 83 ft. in breadth and 163 ft. in length, and formed the roof of an immense hall. To take the outward thrust of the arch, smaller halls were built on both sides and were probably used as guard chambers and storerooms. The crown of the arch is 9 ft. in thickness and the walls at the base 23 ft. The building is built of burnt brick and is one of the very few arched buildings of this period that still remain.



Syria and Grand Lebanon

From Ctesiphon we fly in a west-south-westerly direction towards Syria. This country, together with Grand Lebanon, issued in May 1925 a long series of very handsome view stamps each value being a different type. Both series were designed by J. de la Nézière—already well-known to stamp-collectors as the designer of certain values of the French Morocco pictorial series—and both series were printed by the Helio Vaugirad by the same method as that now employed for the Morocco stamps. An exception is the 0.10 piastre which is lithographed. The perforation gauges 13½ and is apparently done by a comb machine.

The values in both series are as follows: 0.10, 0.25, 0.50, 0.75, 1, 1.25, 1.50, 2, 2.50, 3, 5, 10, 25 piastres of which the 2, 3, 5, 10 piastres values also appear overprinted for the air post. The values of the Postage Due stamps (different views) are 0.50, 1, 2, 3, 5 piastres.



Our first visit in Syria is to Kerak, a town in eastern Palestine a few miles east of the Dead Sea. Here we find the castle, Krak des Chevaliers, built on a rocky summit, a very fine example of a Crusaders' fortress (Syria, Dues, 5 pi.). Kerak is mentioned several times in the Old Testament under the various names of Kir-haraseth, Kir of Moab and Kir-haresh.

Two Ancient Fortresses

From Kerak we fly northwards to Banias, a poor town with a population of only about 350. The 3 piastres of the postage due series shows the fruit trees that surround the town in the foreground, while beyond rises a conical hill on which is the Crusaders' Castle of Subeibeh, one of the best in

Palestine, the land of many such castles. The castle might form the subject of many adventure stories for it was a strong outpost against Damascus and was the scene of many fierce battles between the Moslems and the Crusaders.

Another and similar fortress is that of Belfort (Grand Lebanon, Dues, 3 pias.), often known as Kal at-esh-Shukif, a few miles north of Banias. This stands on a crag on the north bank of the Leontes and is the finest and most important of them all.



We now turn westwards and fly to the coast, to the two famous towns of Tyre and Sidon, now known as Tyr and Saida. The former is illustrated by a seascape on the 1·50 piastres value of the Grand Lebanon series and the latter by a view of buildings on the edge of the sea (Grand Lebanon, 5 pi.) Saida was formerly the principal city of Phoenicia but is now a small town relying for its trade upon the produce of its fruit gardens.

Turning inland again, the 3 pi. of Grand Lebanon shows Deir al-Kamar, an old seat of the Druse amirs, and now that of the military governor of Lebanon. The 1 pi. and 1·50 pi. of Syria (illustrated) show Damascus, the chief town of Syria and reputed to be the oldest city of the world still inhabited, while the 2 pi. of Grand Lebanon shows a distant view of Zahleh, the headquarters of the Greek Uniate, one of the sections of the exceedingly complex population of Lebanon. This value serves in an excellent way to show the hilly nature of the country.



The Ruins of Baalbek

A few miles north-east of Zahleh are to be found the ruins of the immense temple of Baalbek, known in olden times as Heliopolis. The town is 3,850 ft. above sea-level and has a population of about 5,000.

There are in reality two temples, one, the greater, sacred to Jupiter (Baal), Venus and Mercury, and the other built in honour of Bacchus. Only parts of these temples remain but their ruins are sufficient to enable us to see that the Jupiter-Baal temple was approached by a flight of broad steps, when one entered the propylaea, a covered hall or vestibule about 35 ft. in depth and 55 ft. in breadth.

From here three gateways in a beautiful screen gave access to the fore-court. This was hexagonal in shape and about 250 ft. in diameter. Continuing in the same direction a large portal 50 ft. in breadth and two smaller ones formed the entrance to the Great or Main Court which covers about three and a half acres. Here was the High Altar of Burnt Sacrifice.

At the far end of the Court was another flight of steps giving admittance to the Temple of the Sun God. This was originally surrounded by 54 columns 60 ft. in height and 7½ ft. in diameter. Only six of these columns now remain erect and these are shown in the foreground of the 1 piastre of Grand Lebanon and in the background of the 2·50 piastres. These columns are built of three blocks of stone and carry a moulding and cornice.

The extensive ruins on both of these stamps, especially on the 2·50 pi., are of the Temple of Bacchus built on the south of the Jupiter Temple. This temple is much smaller and is also better preserved. The columns surrounding it (of which three are seen on the stamps) were over 52 ft. in height and supported an entablature 5 ft. in height.

We now proceed to the coast again to visit Tripoli (Grand Lebanon, 0·50 and 10 pi.), the chief town of the district of the same name, and then fly due east until we come to Palmyra (Syria, 2p. and 25p., illustrated), which lies 150 miles north-east of Damascus, in an oasis of the Syrian desert, 1,300 ft. above sea-level.

Palmyra was a very important city in ancient times for here met the great trade routes from the Phoenician ports, from the Persian Gulf, from Petra and from South Arabia. It is at Palmyra that there are the huge ruins of the colonnaded street, the best remaining example of the style of Roman architecture. Both the stamps illustrating Palmyra show the street which was nearly a mile in length and 70 ft. in breadth. The central avenue between the columns was open to the sky but the side avenues were roofed over with stone. The columns are of the Corinthian order and 31 ft. in height.

The Water-Wheels of Hamah

Turning in a north-westerly direction we next come to Hamah, about half way between Palmyra and Latakia, which is on the coast. Hamah is situated in the narrow valley of the Orontes and is mentioned several times in the Bible as Hamath. It was one of the most important places in Syria from an early period, its original inhabitants being Canaanites. It now possesses a population of about 40,000.

Most of the houses are of mud (Syria, 0·75 pi.), there are twenty-four minarets (0·10 pi.) belonging to the various mosques, and one of the chief points of interest to the visitor is the number of huge water-wheels used to raise water from the Orontes, one of which is shown in the 0·50 pi. of the postage due series (illustrated).

Continuing to the coast we arrive at the Mediterranean port of Latakia, situated opposite the island of Cyprus. A general view of the front of the town is shown in the 1·25 pi. of Syria. It was almost completely destroyed by earthquakes three times—in 1170, 1287 and 1822. Its best known export is "Latakia" tobacco, which grows in the neighbourhood and which is mostly sent to Alexandria. The town is connected by road with Hamah.



From Latakia we fly inland again due north-east until we come to Aleppo, the most important city in northern Syria. The ancient portion of the town is surrounded by a Saracenic wall provided with seven gates, one of which is shown in the striking view on the 10 pi. of Syria (illustrated). The 5 pi. also shows a view

(*Continued on next page*)

STAMPS FOR SALE

(*Continued from page 512*)

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of Aleppo. This is of the interior of the city. On the mound in the background are the ruins of the mediæval castle, entrance to which is forbidden to visitors.

We now turn due west, passing Antakia (Antioch) (Syria, Dues, 1 pi.), until we once again arrive at the coast, this time at the port of Alexandretta, about 70 miles from Aleppo by road. A general view of the town with mountains in the background is shown on the 0·50 pi. value of the Syrian series. Alexandretta possesses the easiest approach to the plains of north Syria and for this reason has remained an important port in spite of the extreme unhealthiness of the district, which although now drained still leaves much to be desired.

We come now to an end of our tour of these very interesting countries of Lebanon and Syria. In their first distinctive series of stamps they have shown their country to the world; we hope that they will not be encouraged by their success to issue new sets more often than the requirements of their post-offices make really necessary. In the past six years, during which time Syria has used overprinted stamps, over 300 varieties have appeared; and Grand Lebanon has succeeded in issuing nearly a hundred varieties in twelve months!

NEXT MONTH:—

SOUTHERN EUROPE

Steam Locos without Fires—

(*Continued from page* 519)

First Fireless Loco

The first fireless locomotive constructed in this country was built towards the middle of the last century for working through the tunnels of the newly-opened Metropolitan Railway. In this loco a heating chamber was provided which was intended to be filled with heated bricks to assist the evaporation of the water, but how the bricks were heated is not on record. This loco, which was nicknamed "*Fowler's Ghost*" after the engineer alleged to have designed it, was not at all successful, and was withdrawn from service after a few trial trips, generally without a train.

Fireless locomotives of the type we have been considering came into vogue on the Continent, particularly in Germany, about 1907, for use in the great arsenals and munition works. During the war large numbers of fireless locos were built for new factories by Messrs. Andrew Barclay, Sons & Co. Ltd., of Kilmarnock, to whom we are indebted for our illustration and much useful information. Since the war many of these locos have become surplus and have been disposed of to private firms.

Everything for the Aquarium

Readers who are interested in our articles on the keeping of an aquarium will be glad to know that fishes and other suitable inhabitants for tanks may be obtained from L. Haig, Beam Brook, Newdigate, Surrey. Many of the fishes mentioned in our articles are to be had at prices ranging from 6d. upwards and the most suitable aquatic plants are also supplied at very low prices.

Mr. Haig's stock includes almost every kind of aquatic creature, and readers who have an aquarium of their own, or are thinking of making one, would do well to write to him, mentioning the "*M.M.*" and stating their requirements.

It should be pointed out that many aquatic creatures cannot be obtained at short notice, so that readers should make due allowance for a little delay in some cases.

Photography—(*continued from p.* 529).

Orthochromatic plates are no more difficult to use than ordinary plates. On account of their yellow sensitiveness they must not be handled in a yellow light, but if a deep ruby light is employed in the dark room, and the plates are not unduly exposed to this light during development, no trouble of any kind will be experienced. All roll films made to-day are orthochromatic. This is not the case with plates, but there are on the market many excellent brands of orthochromatic plates, both self-screened and otherwise.

NEXT MONTH:—

GASLIGHT PRINTING

Overseas Result

14th Photo Contest

The subject of this competition was "My Best Photograph." Previous contests have shown that our Overseas readers are quite as expert with their cameras as those at home and in this case the standard of the entries was very high indeed. Scarcely any part of the Empire was unrepresented, and there were entries from many foreign countries, the photographs ranging from Canadian winter scenes and views of Indian temples to snaps of Dutch and Flemish canals. A considerable number of the entries had a more domestic character and dealt with family groups and household scenes of various kinds.

The awards were as follows:—First Prizes (Photographic Goods value £1/1/-)—Section A, COLLIS GOOTING (Khalil Lumpur); Section B, B. DALGLISH (Nelson, N.Z.) Second Prizes (Photographic Goods value 10/6)—Section A, F. KEMP (Auckland, N.Z.); Section B, J. M. WILLMOT (Toronto, Canada).

20th Photographic Contest

It is not an easy matter to find, month after month, subjects for photographic competitions that will suit every possessor of a camera, but this month's subject is one that should appeal to every photographic reader and at the same time give no excuse for saying "This subject is out of my reach."

Our subject is "A Road Scene." This may be a view of any kind of road, in the open country, quiet village or busy city. With the present great development of motor traffic interesting scenes abound, and views of road-repairing operations, traffic control points, "white lines" at dangerous corners, petrol pump stations, etc., are all instructive.

Each print submitted must be endorsed on the back with the name and address and age of the competitor and a statement as to whether the developing and printing are his own work. In the event of a tie preference will be given to the entry that has been made entirely by the competitor. A note as to the locality and subject of the photograph will add to its interest and to its value for competition purposes. Prints may be of any size and made by any process and any competitor may submit more than one print if he desires.

Competitors should note that no print can be returned unless it is accompanied by a stamped addressed envelope.

The competition will be divided into two classes, A for competitors of 16 and over and B for those under 16. Four prizes are awarded—Photographic Goods (or Meccano Products) to the value of £1/1/0 and 10/6, to be chosen by the winners, as first and second prizes respectively in each section.

Closing date—30th November (Overseas, 28th February, 1926).

The Conquest of the Air

VII. The Beardmore-Rohrbach All-Metal Flying Boat

SOME considerable attention is being paid to the development of a new system of construction, as applied to aircraft for both land and marine service. This is the use of the well-known light alloy duralumin for the construction of every part of the aircraft, including even the wings.

As most of our readers know, duralumin is a non-rusting alloy that combines much of the lightness of aluminium with the strength and toughness of steel. Even for covering the wings and fuselage, thin duralumin plates are used in place of fabric.

The metal needs no dope, paint, or other treatment, yet is proof against any climatic conditions—in fact, the design of machine would probably be obsolete before its structure showed any signs of wear or deterioration.

Size for size, all-metal machines are lighter than the ordinary type, and, in quantities, they are cheaper to build. They have a higher wing loading, and consequently a better speed and general performance.

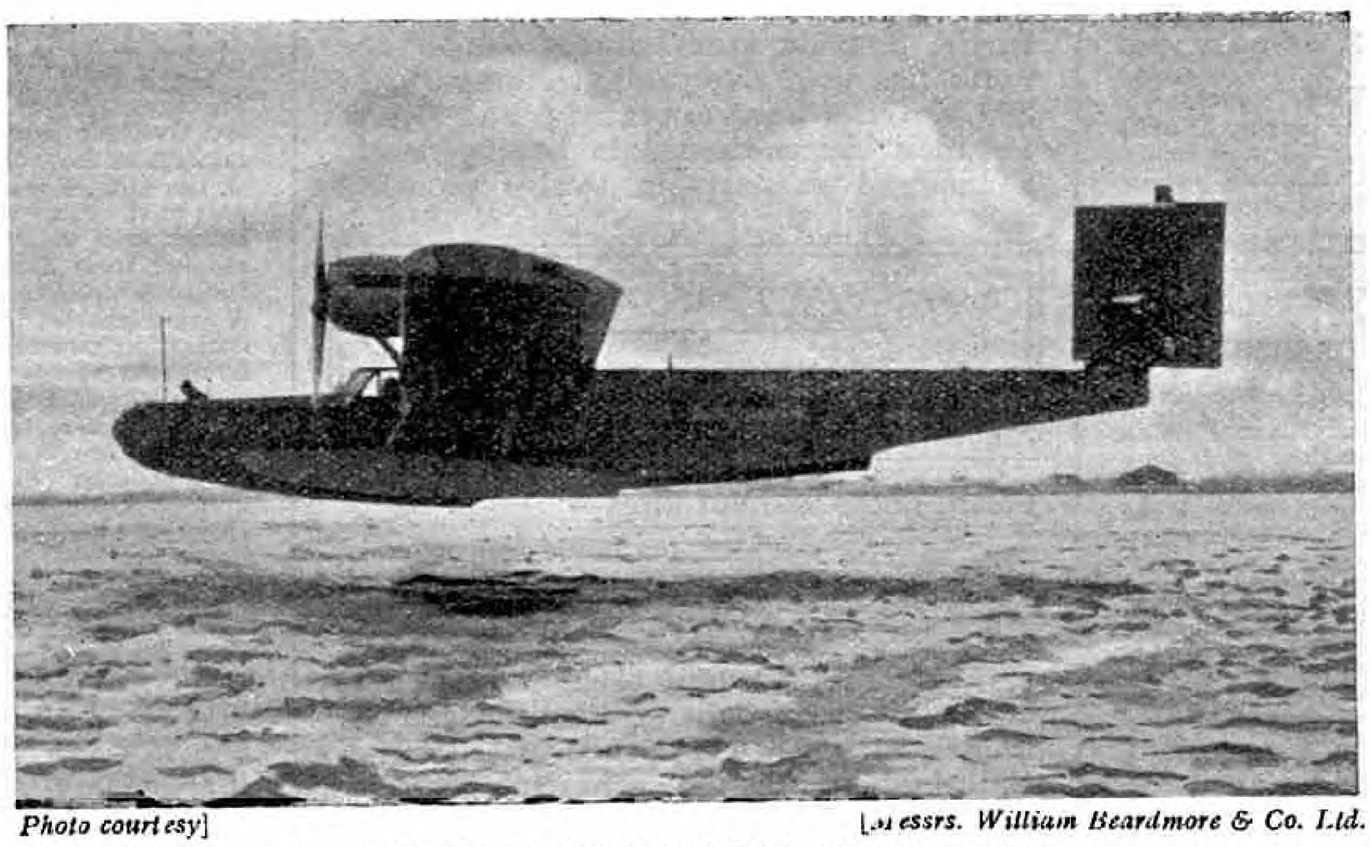


Photo courtesy [*Messrs. William Beardmore & Co. Ltd.*

The Beardmore All-Metal Flying Boat on Test

A German Invention

The system, which was originated by Dr. Rohrbach, a German expert, is being developed in this country by Messrs. William Beardmore & Co. Ltd., at their Dalmuir works.

Top Speed—120 Miles per hour

A short time ago Dr. Rohrbach visited London and in a lecture before the Royal Aeronautical Society dealt with his experiments with machines of this construction. In his lecture Dr. Rohrbach dealt chiefly with a large twin-engined monoplane with a high wing loading for which he claims many advantages.

In this machine side floats are fitted—in addition to the usual flying boat hull—and they add considerably to the stability of the boat on the water—indeed, it will stand up to quite a rough sea and a high wind.

With two Rolls-Royce Eagle engines, the maximum speed is about 120 m.p.h., and the landing speed between 65 and 68 m.p.h. In still air the machine takes off from the water in 27 seconds.

Cantilever Wing System

The wings of the monoplane described by Dr. Rohrbach, are constructed on the cantilever principle, and the leading and trailing edges—that is, the extreme front and rear portions of the wings—are detachable. The strength of their construction was well illustrated when, during trials at Copenhagen, sixteen men walked on them without doing any damage.

The ingenuity of the designer is strikingly evidenced by some of the details. For instance, should one engine fail, the pilot can set the tail fin so as to counteract the uneven pull exercised by the remaining engine.

An Aeroplane with Masts and Sails !

At the lecture Dr. Rohrbach, who worked on the design of the earlier Zeppelins and was largely responsible for that of the famous Gotha bombers, showed slides and cinema films of his all-metal flying boats on test at Copenhagen. An interior view of the hull revealed the portholes and other accoutrements of a comfortable cabin cruiser.

There was an excusable murmur of amusement at several views of the flying boat with masts and sails rigged, and evidently making good headway in a rough sea. The lecturer stated that she performed excellently as a yacht, even against the wind, and could make over four knots with the gear shown, while a much larger area of canvas could be fitted. This is, of course, an important advantage in case of complete engine failure at sea.

In a discussion following the lecture, Flight-Lieut. Lucking described tests with an ordinary wood-and-fabric seaplane to determine how far its structure was water-proof. An 18,000 lb. machine, after a day or two at anchor in harbour, was found to have gained no less than 600 lb. in weight, and this after all leaks had been accounted for and carefully drained out. That is a heavy handicap, and one that metal construction almost entirely eliminates.

Built like a Bridge

The constructional principles adopted in the Rohrbach-Beardmore machine are similar to those in use for bridge and shipbuilding work, and the structure is built up of riveted girders and plates. This makes it possible to employ larger wing-spans and higher powers than have hitherto been employed for flying boats of this class.

The all-metal flying boat illustrated is of the monoplane type, with cantilever wings arranged at an enhanced dihedral angle. A rectangular-shaped fuselage to which the wings are secured forms the hull of the ship. Metal stabilising floats, which give further support to the machine on the sea, are fitted.

Rolls-Royce " Eagles " Fitted

The engines are situated above the wings and raised clear of them by metal struts—an arrangement that enables manœuvring to be easily carried out with only one engine running. The leading dimensions of the boat are :—

Span over wing tips 95 ft. 9 in.
Overall length 54 ft.
Overall height 15 ft.

The weight of the machine when fully loaded is 8,140 lb. which gives with a useful load of 4,400 lb. a total weight fully loaded of 12,540 lb.

At ground level the machine is designed for a speed of 124 miles per hour. It is capable of flying to a height of 13,000 ft. and is designed to fly without losing height when loaded to three-quarters full load and with only one engine running.

The engines which so far have been fitted to these boats are of the Rolls-Royce " Eagle IX " type, each having twelve cylinders with a bore of $4\frac{1}{2}$ in. and $6\frac{1}{2}$ in. stroke. When running at a rated speed of 1,800 revolutions per minute the motors are designed to develop a total of about 720 brake horse-power.

Wings of Immense Strength

Some of the main constructional features are as follows :

The characteristic feature of the three-part wing construction is clearly shown in the accompanying illustration. A centre member of box section built up of duralumin plates, channels, angles, with internal lattice bracing, and a stressed skin which helps to carry the main load.

The scantlings are thicker near the hull and decrease in thickness outwards from it. The wing girder is secured to the hull structure by steel bolts on its upper and lower surfaces, which are supplemented by diagonally placed bolts and straps on the sides. The wing is so strong that the crew can safely walk about on its surface from end to end, a feature which is of considerable value in tying up or other sea work. The auxiliary stabilising floats are attached below the wings on either side of the hull and are secured to hull and wings by struts.

The hull is entirely made of light alloy and is generally rectangular in section, with a specially stepped under surface, the shape of which has been determined by an extensive set of tank experiments. It is divided into water-tight compartments by bulkheads with closing doors of an inverted pear shape and is designed so that the machine will float with any two compartments flooded.

Remarkable Advance in Flying-Boats

The cockpit is placed well forward of the wings, with glazed observation windows. At the extreme stern of the fuselage there is a built-up turret, which supports the tail pieces. Attached to the upper part of the hull and the wings are the motor supports, which take the form of hollow metal struts and carry the motors and propellers clear of the wing structure.

The arrangement of the engines gives considerable flexibility when manœuvring, even with one motor in operation. Both at sea and in the air control has proved to be singularly effective, while by means of the side lateral floats the boat is well under control, even in a sea of considerable magnitude.

Generally speaking, the opinion which has been formed as the result of the tests so far carried out is that the machine described constitutes a remarkable advance in flying boat practice. The machine, it is claimed, is also a successful example of the application of the high wing loading theory, which opens out such an enormous field for the extended use of aircraft and makes possible flights up to a range of 2,000 miles without the necessity of landing.

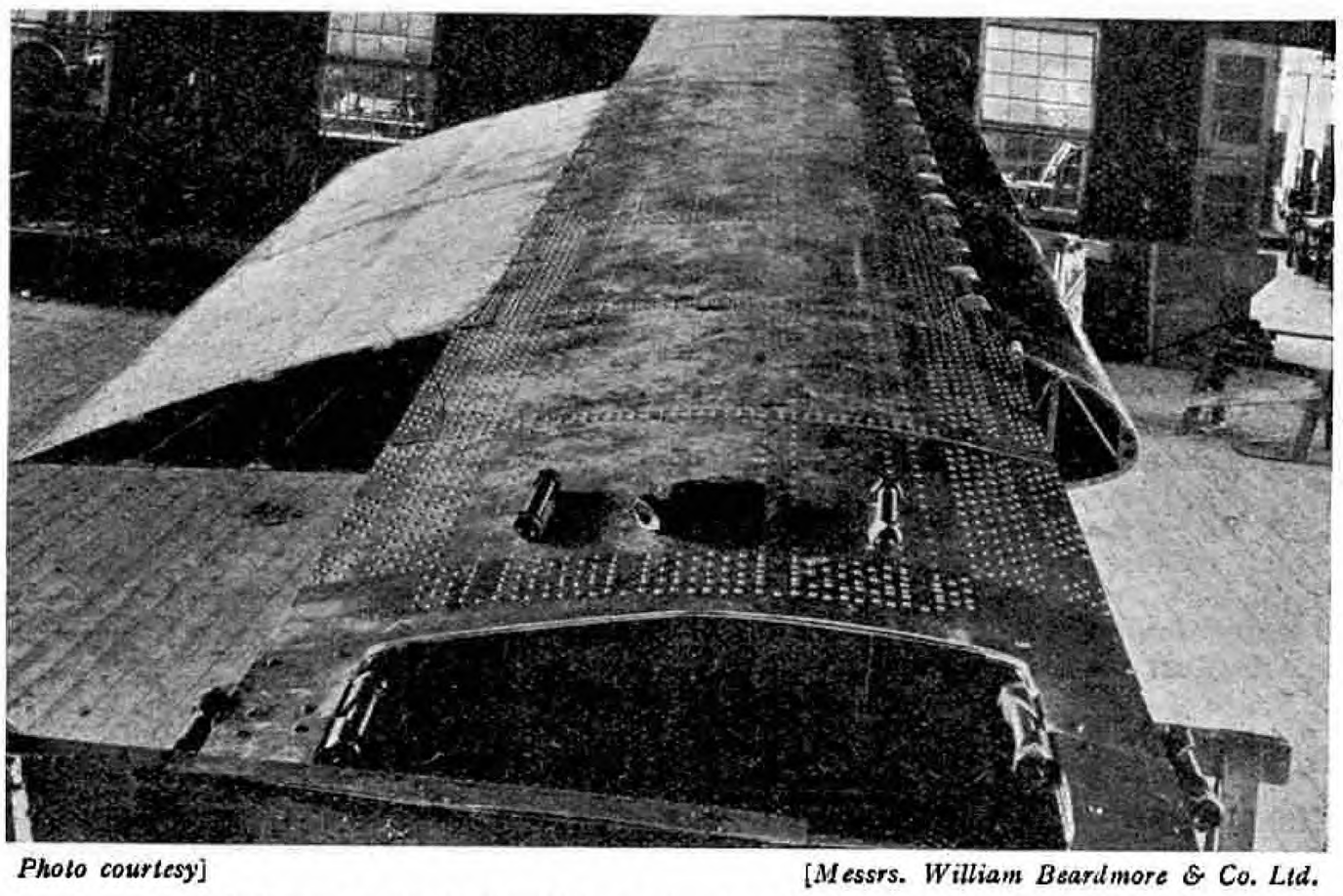


Photo courtesy [*Messrs. William Beardmore & Co. Ltd.*

A Near View of the Wing, showing the metal construction

SAFE FLYING IN FOGS

Fog is the greatest enemy of the air pilot, for he flies by sight and if he is unable to see he is obliged to land. A great deal has been done already to substitute electric signals for the eye during fogs, in order to facilitate landing in busy aerodromes. Roughly speaking, the method adopted consists of radiating strong electrical impulses from cables laid along the ground across the aerodrome. These electrical impulses affect delicate mechanism in the aeroplane, and so long as the machine remains within the influence of these impulses—this being indicated by a red light glowing on the dashboard—the pilot is assured of a safe landing.

It is probable that before long pilots will be directed during fogs from a control tower situated in the centre of the aerodrome, from which will be sent out to incoming machines the necessary instructions to enable the pilots to land with safety.

By means of an elaborate system of electrical signalling it should be possible to carry on the great air services in any weather, and fog would then cause no more delay to aeroplanes than it does to the main line expresses of our railways.

OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

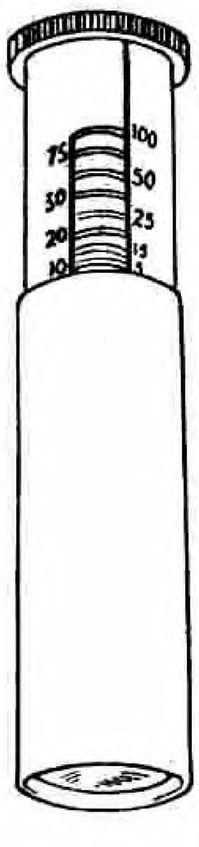
Every day new inventions and ingenious labour-saving devices are being brought into existence. From time to time the most interesting of these will be described and illustrated in these columns. Readers are invited to send particulars (accompanied if possible with photos, sketches, or cuttings) of any interesting inventions or devices that may come to their notice. Payment at our usual rates will be made for any contributions used.

A Wardrobe Chair

A very handy chair has been produced by a New York manufacturer, in which drawers for small articles and a shelf for shoes are fitted, whilst the back is shaped to receive a coat with a clip attached on which to hang the trousers. A foot-rest slides from underneath on which to rest the shoe when untying a bootlace.

Such chairs will be found exceedingly useful in any room where space is at a premium.

A Photographic Range Finder



An invention that will be welcomed by many amateur photographers is this small device to measure distances. Shaped like an ordinary telescope, it is pointed at an object and the end is pulled outward until the image is sharp on the ground glass screen. A scale on one side of the instrument then indicates the distance of the object in feet. The device fits into the vest pocket and with it the distance of any object may be measured in a few seconds. This device will also be of use to Boy Scouts and others who wish to determine accurately the distance of any object. The Range Finder is graded only up to 100 ft., but the register might easily be increased with advantage.

Trains Switch on Station Lamps

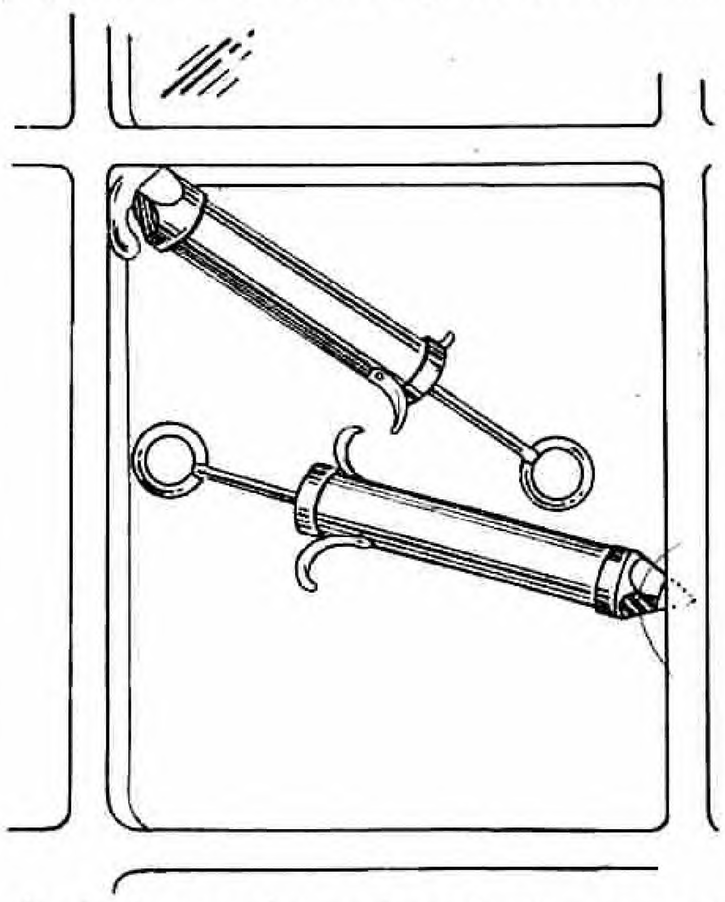
On the American and Canadian railroads there is a number of small wayside stations where trains stop only by special arrangement with passengers who wish to alight. As it obviously would be too expensive to keep these stations lighted throughout the night, the Southern Pacific Rly. Co. has recently adopted an ingenious invention by which the stations are automatically lighted on the approach of passenger trains. A patent switch is attached to the rails about a mile from the halt. As the train crosses over this point, a circuit is closed and the station lights snap on. At the same distance beyond the station the lights are turned off by the train as it passes over a device that releases the circuit. Apart from the economy and greater protection of passengers that is effected, the lighted stations also serve as guides to the drivers on the swift through trains.

Wristlet Rear Light

Another article for the benefit of motorists when driving at night is a small red reflector which has recently been produced to be fixed to the back of the hand by means of rubber bands round the middle finger and wrist. When desiring to turn a corner the motorist has only to put out his hand in the usual way when the lights of any car following behind will be reflected red, and warning thus given.

Putty "Gun"

For glaziers and carpenters, a "gun" has been designed so that putty may be applied in any desired place evenly and



firmly from a plunger barrel. The end of the tool is angular and so shaped that it fits the space between the glass and the frame. A great advantage of the device is that the putty is kept from drying-up and so is always ready for immediate use. The "gun" is easily carried in the pocket and as it is simple to use it should prove a popular invention.

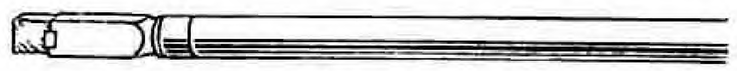
A Convenient Button

Anyone who has ever tried to sew on a button knows how the needle will insist on dodging the hole through which it should go. A button recently designed to eliminate this, is so moulded that the needle is guided easily into the holes, which are funnel shaped instead of having straight sides as is usually the case. The holes are also arranged so that the distribution of the stitches is spread over a wide area of the cloth.

The button is hollowed out at the back to receive the mass of cotton which is usually wrapped round the stitches, so that it lies flat against the article to which it is stitched.

Adjustable Rubber

Most boys have had the annoying experience of finding that, just when it is



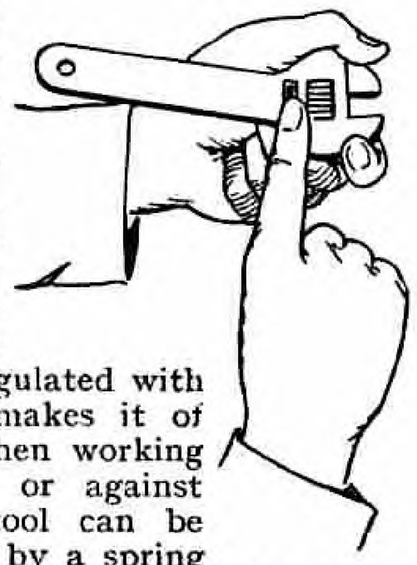
needed most, the rubber in their pencil has worn down or dropped out. These troubles are not experienced by owners of pencils fitted with one of these adjustable



erasers in which the rubber is placed in an adjustable clamp in a socket at the end of the pencil. It may be pulled out as it becomes worn down and will thus last considerably longer and never become loose. The clamp is removed easily, and after taking another "bite" on the rubber, is slipped back into place again.

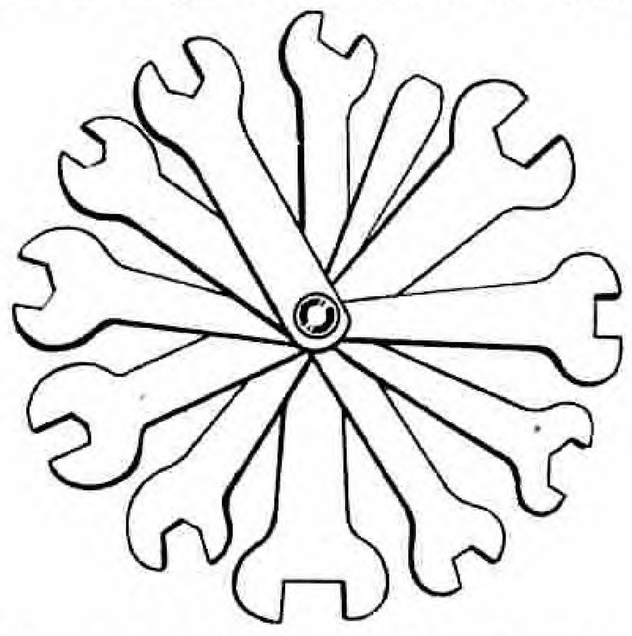
One Handed Spanner

An adjustable wrench that can be manipulated easily with one hand has recently been manufactured by an American firm. It is fitted with a moveable jaw that locks on a nut by pressure from the thumb. The fact that it may be regulated with only one hand, makes it of particular help when working in small corners or against walls, and the tool can be released instantly by a spring located in the handle. The grip is shaped to give a firm hold with either hand and a strong leverage for turning is also ensured. Much time may be saved by means of this device in adjusting the jaws to a number of nuts or bolts of different sizes, as they can be quickly and very easily fitted.



"Nest" of Spanners

The "nest" of spanners illustrated here can be folded up to occupy no more space than a single tool. There are eleven



different sized jaws in the bunch and also a screwdriver. All the spanners are mounted on the central pivot, and on account of its compactness the device is very popular with car owners, as a spanner for almost any nut on a car is included.

Steam Locos Without Fires

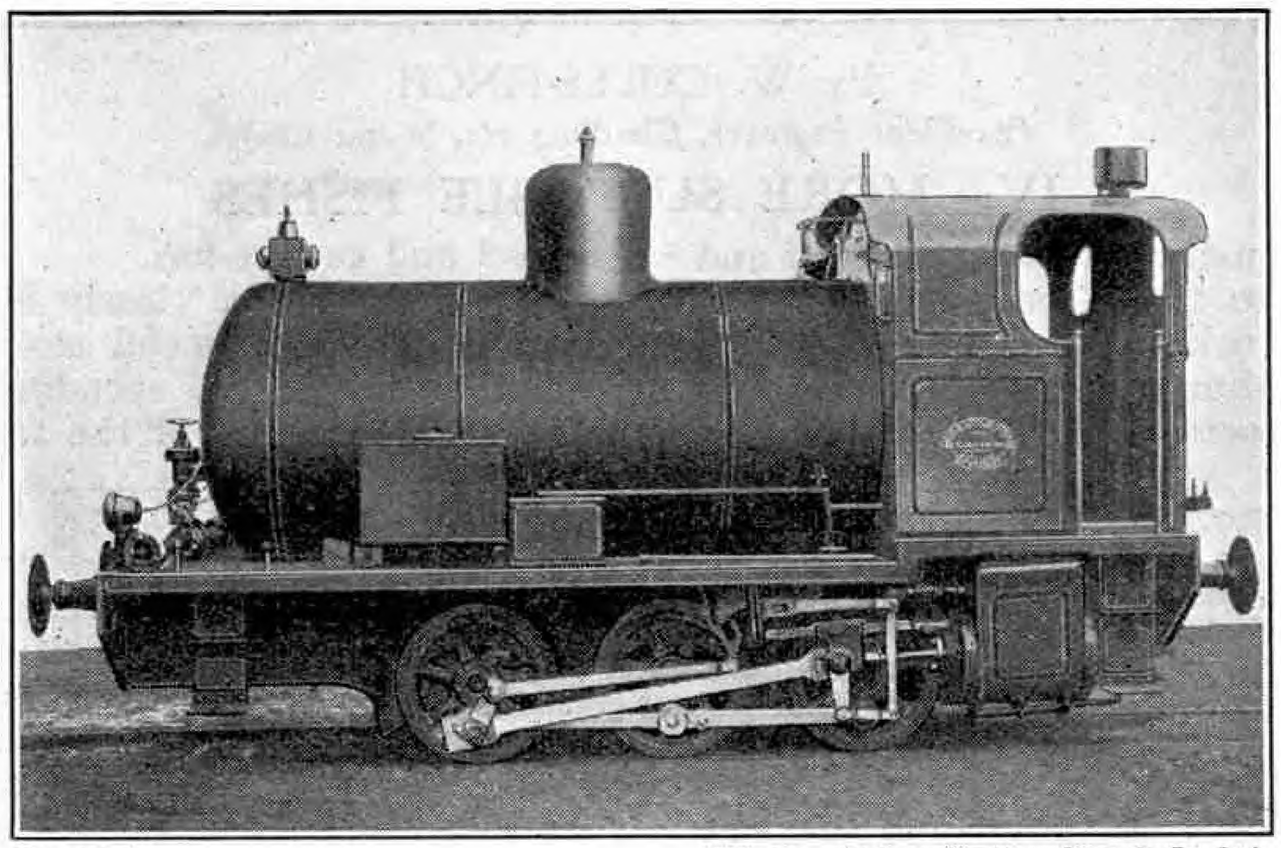
An Interesting Type of Engine used for Special Purposes

THE enormous development in recent times of explosive factories, ammunition depots, oil refineries, paper works and warehouses, in which the materials handled are either violently explosive or extremely inflammable, has created a demand for a safe motive power for shunting operations. For work in any such situation the ordinary steam locomotive is obviously out of the question on account of the danger of fire. There are strong elements of danger also in the employment of internal combustion engines, and even the apparently harmless electric motor is not entirely above suspicion.

The ingenuity of inventors has therefore produced a solution to this problem in the form of the fireless steam locomotive.

Fire Danger Eliminated

As its name indicates, the fireless steam locomotive has no fire. Thus sparks and cinders do not exist, and if the brakes and buffers are covered with some non-sparking material the fire danger is practically eliminated. In addition there is no danger of explosion. Not only is the working pressure very moderate, but, as we shall see later, it cannot rise through oversight or accident, but is always falling.



Courtesy [*Messrs. Andrew Barclay, Sons & Co. Ltd.*

Fireless Steam Loco Built for Use in a Munition Factory

Our illustration shows a typical modern fireless steam loco, built for service in a munition factory. It is of the 0–6–0 type with outside cylinders 14½ in. diameter by 18 in. stroke and slide valves actuated by Walschaerts valve gear. The wheels are 3 ft. diameter. A comfortable cab is fitted and the exhaust from the cylinders is taken by a single pipe up the cab backsheets and discharged through a patent muffler above the cab roof.

In addition to a Caledonian-type whistle there is a warning bell attached to the front of the cab, and electric headlights are fitted. Surmounting the dome is a single Ross pattern "Pop" safety valve, but this fitting is for special use only. The only other attachments are the regulator, hand-brake handle, steam gauge and sanding apparatus, so that the simplicity of control will be readily appreciated.

How the Loco Works

The principle upon which the loco works is quite simple. What appears to be a boiler of unusually great diameter is really a large cylindrical tank known as the "receiver," the greater part of which is filled with water. The receiver has rounded ends and is fitted internally with special steam distributor pipes and numerous surge plates.

The steam supply is conveniently obtained from a stationary boiler, and the short length of piping for attachment to the inlet valve, seen at the front of the loco above the buffers, is usually of a patented spherical-jointed type allowing a fair working variation in the position of the loco when being presented for charging. The water in the receiver is heated up until a pressure of 160 lb. per square inch is obtained, and the charging operation being now complete, the inlet valve is closed and the loco disconnected from the charging boiler.

The time normally required for charging when hot from, say, 15 lb. per square inch to 160 lb. per square inch, is from 15 to 20 minutes, but the initial charging from cold—which need only be done at long intervals, say after the loco has been out of commission for 10 days or more—requires about 3½ hours.

On opening the regulator, the steam passes from the dome to the cylinders just as in the case of an ordinary locomotive and after doing its work escapes through the exhaust muffle with a faint "puff."

When charged with steam the loco will perform ordinary shunting and general haulage work for three or four hours. Boosting charges can be given rapidly and whenever convenient. The power is not so great as an ordinary loco of the same dimensions, as the working pressure of the fireless loco falls gradually as the steam is used.

Work in the factory or wherever the loco is situated is very frequently arranged in such a manner that the charging is accomplished during the meal hour.

A Steam Accumulator

The fireless locomotive is really a steam accumulator, the power being stored as heat in the water in the receiver. During the working period a portion of the water in the receiver evaporates, forming the steam for driving the loco. This is due to the fact that, with water and steam in contact under pressure and at corresponding temperature, if the water be relieved even slightly in pressure a certain amount of heat is liberated, generating steam until thermal equilibrium is established. This process goes on until the pressure falls too low for further work, say about 25 lb. per square inch, at which pressure the loco is able to run light quite a long distance to the charging station.

When steam enters from the outside boiler it is condensed in the cooler water of the receiver and it gives up heat to the water until the steam pressures in both boiler and receiver are approximately equal. This is the reverse of the evaporating process that takes place during the working of the loco and it results in always maintaining approximately the same level of water in the receiver after charging.

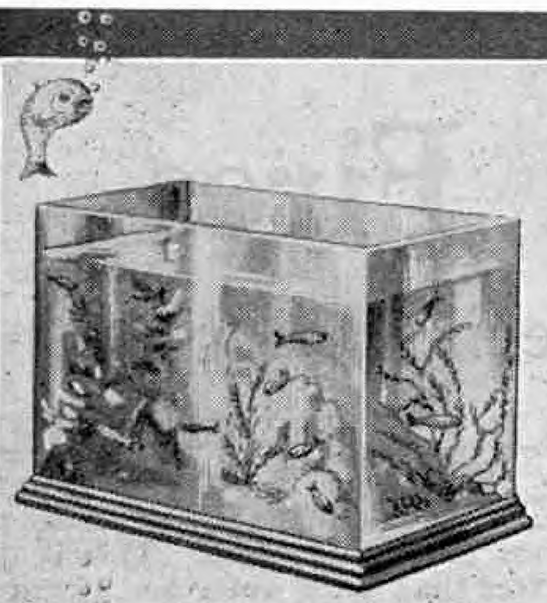
The receiver is elaborately lagged with asbestos so that the loss of heat through radiation is practically negligible and thus, as steam is used by the regulator, more is generated to take its place. If the loco should not be needed for a period up to three or four hours it may be left without supervision and during that time there will be no appreciable falling in pressure.

Increasing Field of Employment

These locomotives are ideal shunting engines where moderate loads are to be handled and the gradients are not excessive. They must always keep within range of the boiler that charges them but are very seldom stranded for lack of steam because they are able to run light for about a mile after the pressure has dropped as low as 25 lbs. per square inch, provided the track is fairly level.

In addition to its use in munition and other factories, the fireless locomotive is finding increasing employment in factories where cleanliness is an absolute essential, and in which, quite apart from the fire danger, ordinary locos could not be used on account of smoke and fumes. There is little doubt that fireless locomotives have a great future in jute, cotton, and paper mills, biscuit factories, power stations, dye works, margarine works, soap works, oil fields and refineries, and a variety of other industries, for they can be safely run into and through the building no matter what manufacturing operations may be in progress.

(*Continued on page* 515)



How to Start an Aquarium.



By W. COLES-FINCH
(Resident Engineer, Chatham etc. Water Co.)

IV. MORE SUITABLE FISHES

In previous issues we have dealt with the making and preparation of an aquarium and have described some of the fishes suitable for tank life. In this instalment, after dealing with a few other suitable fishes, we pass on to the fascinating subject of pond life in the aquarium, which subject will be dealt with at greater length next month.

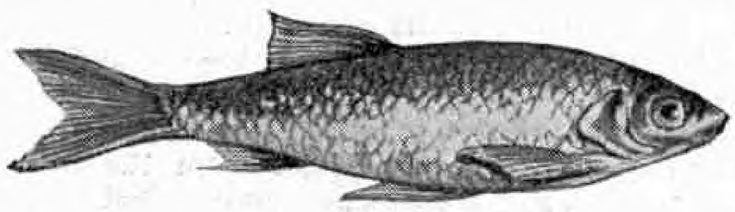
IN the previous article illustrations were given of and reference was made to those specimens of fishes with which to first stock an aquarium—the Carp family (*Cyprinidæ*), the Minnow (*Leuciscus phoxinus*), and the Golden Orfe (*Leuciscus orfus*). Having now gained some little experience in the management of his tank, the reader will do well to extend his interest to other hardy specimens suitable for the aquarium, presuming of course that success has so far followed his first effort and that the fish are healthy and happy in their new environment.

In the writer's experience the following fishes are suitable :—Roach (*Leuciscus rutilus*) ; Rudd (*Leuciscus erythrophthalmus*) ; Dace (*Leuciscus vulgaris*) ; Chub (*Leuciscus cephalus*) ; Gudgeon (*Gobio gobio* or G. *fluviatilis*) ; Loach (*Nemachilus barbatulus*) ; Tench (*Tinca tinca* or *T. vulgaris*) and Perch (*Perca fluviatilis*).

The Roach is a general favourite, and no aquarium can be considered complete without the inclusion of a specimen of this most attractive and graceful creature. It is silvery-white, with greenish back, the lower fins usually being tinged with red.

The Rudd resembles the Roach to some extent but is deeper in the body.

The Dace is another bright-silvery fish, but more slim in form than the Roach. It is a hardy fish and has quick and graceful movements. Its name is derived from the old English "Darse" or "Dart," by reason of its peculiar darting method of making headway against a swift-flowing current.



Dace
(*Leuciscus vulgaris*)

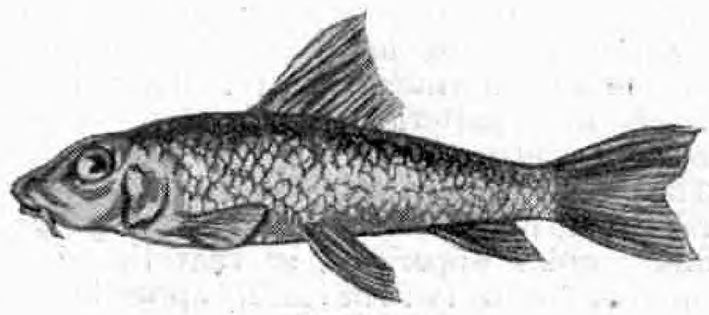
The Chub is closely related to the Dace and like the latter should find a place in the aquarium.

The Gudgeon is another fish admirably adapted for tank life. Its colour is brownish or greenish above and silvery or golden on the sides and below. Often it has small scattered brownish spots on the upper parts and a row of larger blackish spots along the middle of the side, with a series of small dark spots on the dorsel and caudal fins.

The Loaches are closely allied to the Carp family, but have an ungraceful elongate body. They are of sluggish disposition, spending most of their time on the pebbly bottom of the tank. The six barbules at the mouth give the fish an unpleasing appearance, which is very different from the generally sharp and graceful outlines of other fishes. The ugly appearance at any rate makes it easy to readily recognise the species, should its long straight body not have been a sufficient guide in this respect. The Loach should not be entirely overlooked on account of its appearance, for as a saving grace it may, in common with many other fishes, be readily tamed.

The Tench resembles the Loach in that it is a sluggish fish, spending its time in a similar lazy manner. Its iridescent scales of green-bronze, which seem to scintillate with every movement, offer ample compensation for its idle habits. It is often referred to as the "physician fish," for there is an old tradition that its touch cures the maladies of any fish with which it may come in contact. Indeed, its presence in the tank is said to keep away sickness from the other inmates. If only for the contrast they offer in company with the fishes of silvery-whiteness, the golden-tinged, olive-brown Carp and the darker bronzed Tench should be introduced in the aquarium whenever possible.

The Perch is a beautiful and attractive fish. It has a greenish-olive back, sides that shade to golden-yellow or white at the belly, and is marked along the sides with vertical bars of darker hue. It is a voracious fish, however, and does not readily adapt itself to life in the aquarium.



Gudgeon
(*Gobio fluviatilis*)

One final word in reference to "suitable fishes." Whenever the aquarium is large enough to accommodate them, a little shoal of Minnow should always be introduced. They are the life and soul of an aquarium, and to the writer a tank without them would present

a very tame appearance.

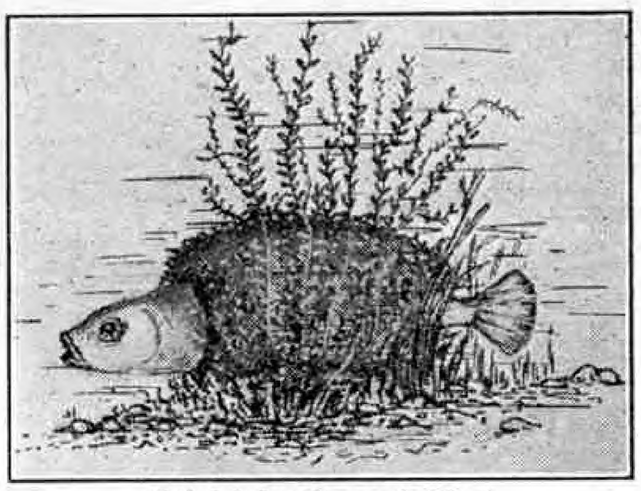
All the fishes enumerated may be readily procured from the dealers, for doubtless the majority of readers do not live near to either a stream or a river. To those who are more fortunately placed in this respect, however, there is an added charm in capturing ones own specimens, or in accompanying an angler or fisherman with a like intent.



Chub
(*Leuciscus cephalus*)

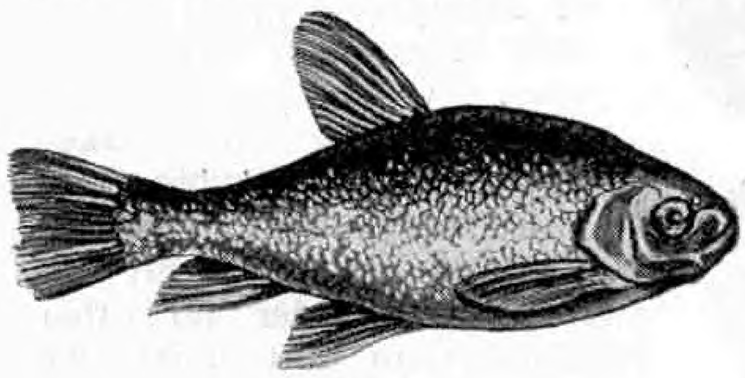
It is the writer's privilege to live near the river Medway and its delightful tributaries, and the manner in which many of his fishes are obtained may be of interest. At certain times of the year the fisherman (not the anglers) pursue their calling in the higher reaches of the river. Here, perhaps they net the delicate Smelt or other fishes that travel beyond the salt tidal waters to where the fresh water from the hills intermingles. These fisher folk are a kind and genial set of men, ever ready to help in this matter. If one gets on friendly terms with them they will readily look out for desired specimens and, when hauling in their nets, instead of throwing back into the river these little wanderers from the upper waters, place them in the "well" of the boat or in some receptacle for the aquarium enthusiast. Fine healthy specimens are often obtained in this manner.

Before proceeding to deal with the introduction of pond life into the aquarium, it will perhaps be of general interest to give a few additional hints based upon a host of queries received. Several readers who have written to the Editor have failed to keep fish in their aquarium solely through introducing them before the material used in the construction of the tank had become sweet and before the plants had established themselves. In this matter the instructions given in the first of this series of articles, under the heading of "General Hints," must be strictly followed.



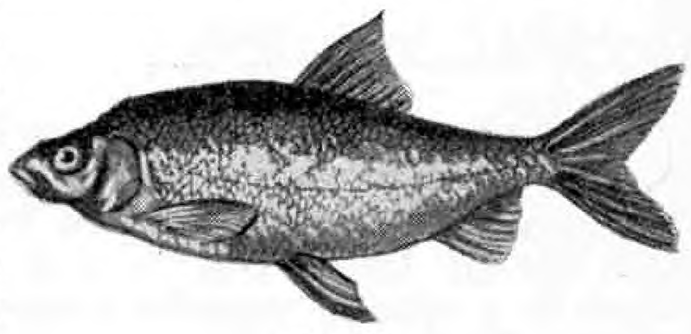
Stickleback and Nest

Other readers seem in difficulty on the matter of the temperature of the water. Provided the water never sinks absolutely to freezing point, fishes prefer cold to heat. Even if the water be ice-cold they will be perfectly happy. It may be of interest to mention an experiment to test this, but it is advisable that the reader should not attempt to repeat it unless it is convenient for him to guard against actual consolidation into ice of the mass of the water taking place, with the inevitable result of a burst tank!



Tench
(*Tinca vulgaris*)

The writer set his tank where it could be partially protected, but where a sharp freezing current of air could play upon one side of the tank only. From this exposed side long spears of ice spread out across the tank in a most fantastical manner, radiating in fanlike form, each separate spear resembling the blade of a carving knife with saw-like edges. The fishes were not unduly alarmed and appeared to be merely wondering what was happening in their home, and, in no way perturbed, they threaded their way in and out of the icy spears. Indeed, although some of the fish became entangled between the spears and plates of ice and were unable to move for many hours, when the ice melted they were no worse for their imprisonment.



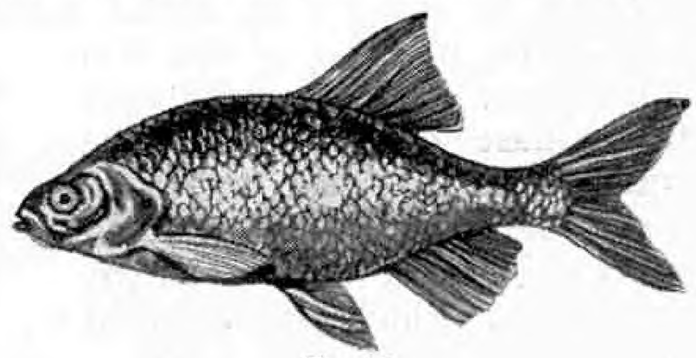
Roach
(*Leuciscus rutilus*)

Curiously enough, during this experiment no film of ice appeared upon the surface of the water in the tank. As the cold draught beat against one exposed side only, it was from this point the icy spears originated and, extending into the slightly less cold water in the other half of the tank, almost reached the opposite side.

Fish certainly prefer cold to heat, for the simple reason that the warmer the water the less its capacity for dissolving and retaining in solution the necessary gases. It is obvious that less oxygen is available under these conditions, so that the water becomes more quickly exhausted and the fishes suffer accordingly. It is therefore wise to avoid extremes of either heat or cold, maintaining as even a temperature as possible, erring in preference on the side of low temperature.

With water at a low temperature fishes become less active and less inclined to take food, but as they are undoubtedly happy, this is all that matters. In cold weather the inmates certainly demand less attention, and the revivifying of the water should scarcely be needed through the winter months, if plant life is thriving and the tank is not overstocked.

The aim should be to keep and preserve the fish in such healthy and congenial surroundings in their now diminutive water-world that they are enabled to live happily for many years. Further, by careful and thoughtful attention it is possible to train the fish so that, when one approaches the tank, the inmates will come towards the side of the tank and, as a tempting morsel is proffered, rise to the surface and take it from the fingers, or nibble at the friendly fingers in playfulness.



Rudd
(*Leuciscus erythrophthalmus*)

This should be a full compensation and reward for the little effort that has to be made to successfully keep an aquarium, and as a lover of fishes I would add: If it is not possible to devote this small amount of care and attention, do not start an aquarium, but turn your attention to a hobby in which suffering will not

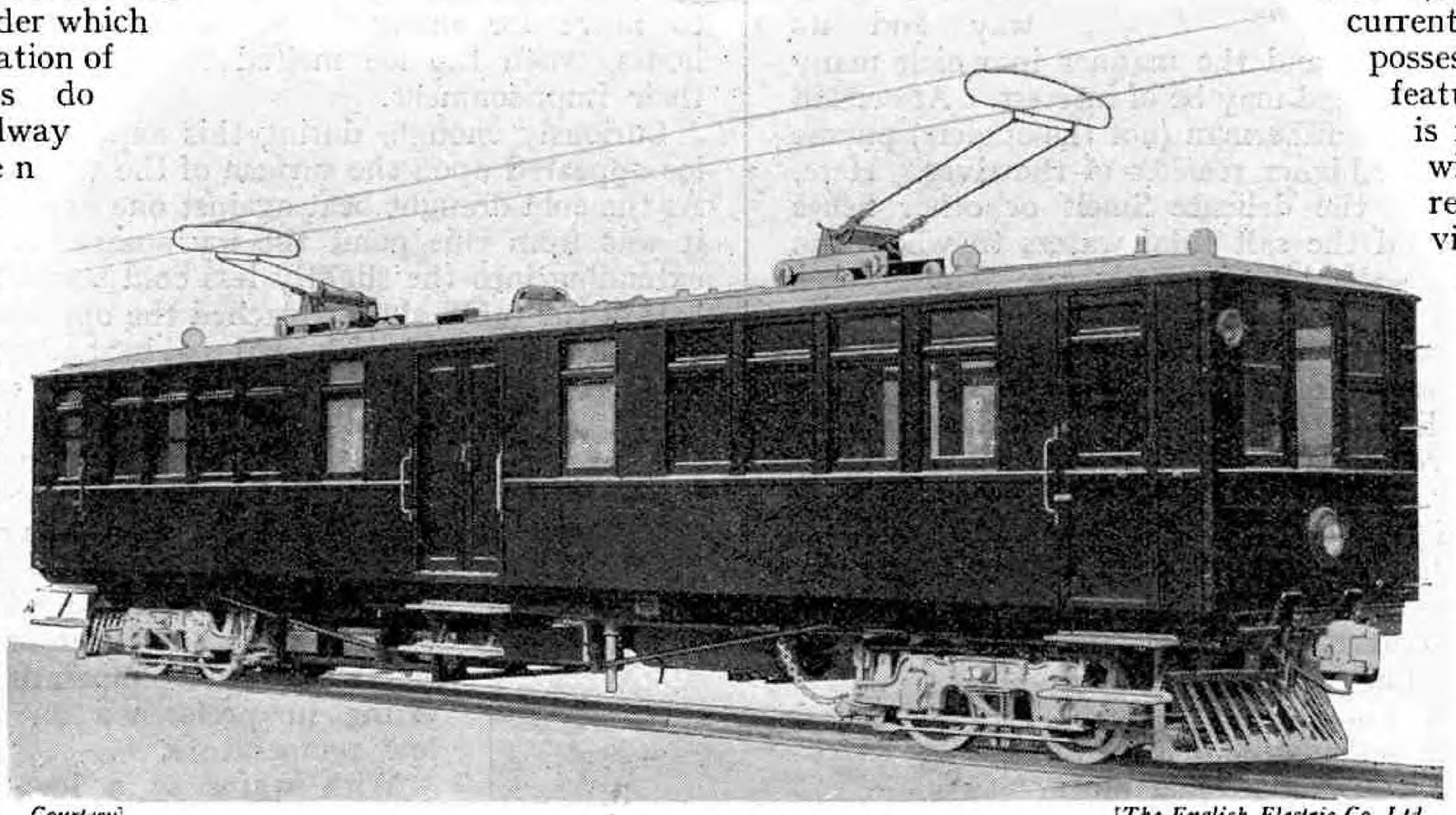
(*Continued on page* 527)

New Electric Railway for Brazil

Electrification of the Campos do Jordão Line

GREAT strides have been made in railway engineering in Brazil during recent years and many important schemes are now in hand for improving the various lines. One of the most interesting of these is a scheme recently completed by The English Electric Co. Ltd., under which the electrification of the Campos do Jordão Railway has been carried out.

There are many interesting features about this work, one of which is that although the length of the line is only about 30 miles, yet in that short distance it rises to a height of 6,000 ft.



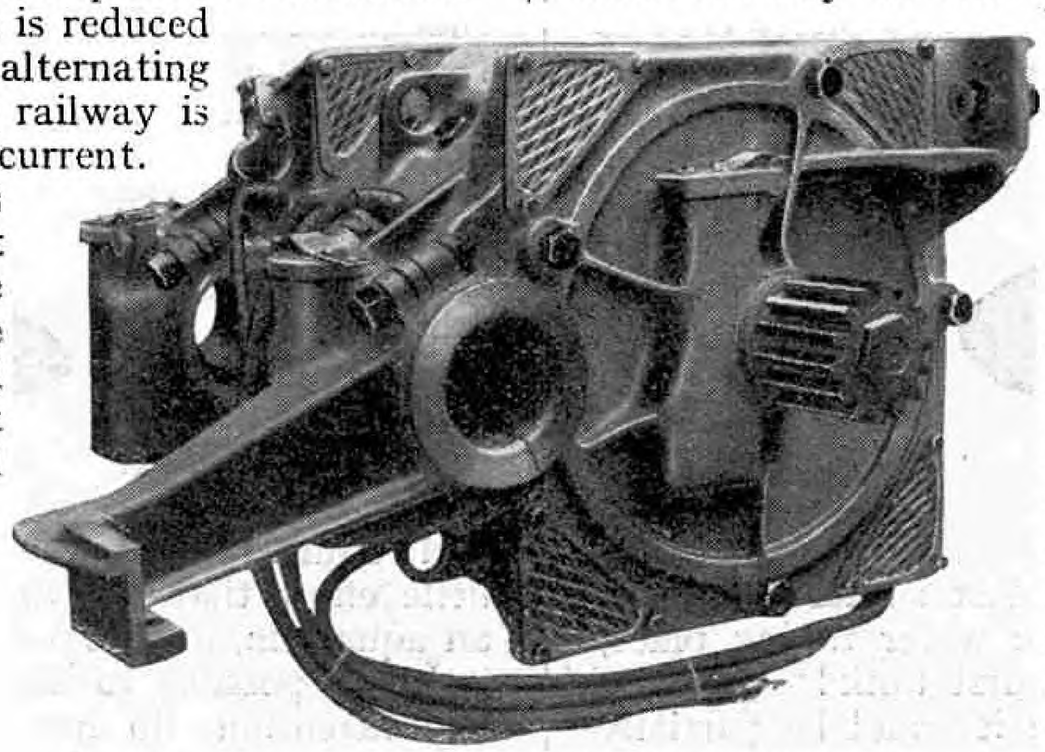
Courtesy] [The English Electric Co. Ltd.

First-class Passenger Coach

Reducing 30,000 Volts to 2,000

The current available from the power company is three-phase current at the high pressure of 30,000 volts. This voltage is of course too high for use on the railway and it has to be reduced. For this purpose the current from the power company's lines is conveyed by means of an overhead transmission line to a sub-station situated close to the railway track. There the current is passed through a step-down transformer by means of which its pressure is reduced to 2,000 volts. It is still alternating current, however, whereas the railway is designed to operate on direct current.

In order to bring about this conversion, the 2,000-volt three-phase current from the transformer is used to drive a suitable motor direct coupled to two 750-volt direct current generators, which are coupled in series so as to give 1,500 volts. This motor-generator set, which is of the "English Electric" standard heavy traction type, has a speed of 1,000 revolutions per minute and a normal rating of 500 kilowatts. Heavy overloads are liable to occur in electrical systems supplying current for traction purposes and the set is capable of giving an overload of 50 per cent. for two hours.



Courtesy] [The English Electric Co. Ltd

"English Electric" 60 h.p. Traction Motor

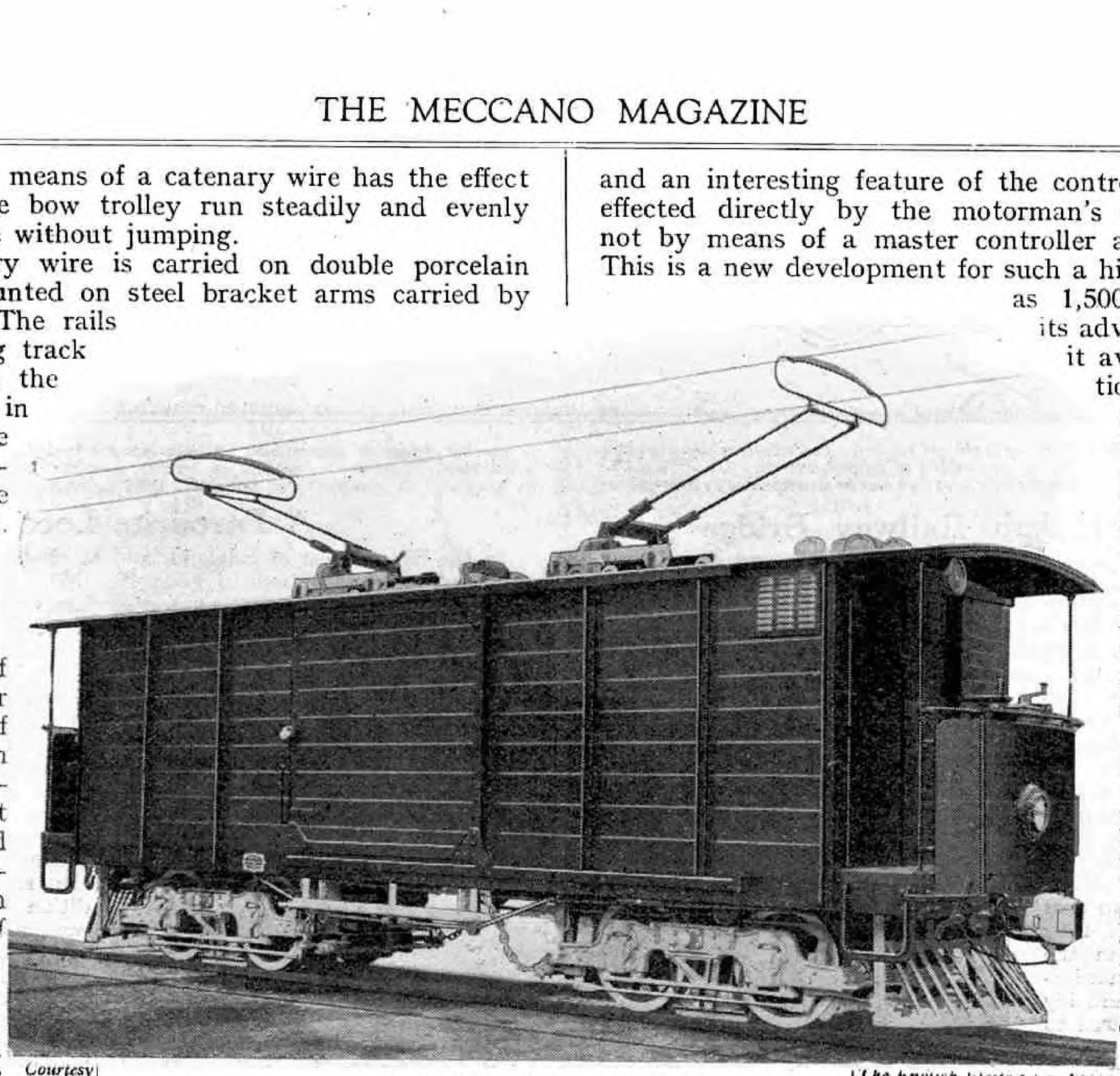
A Novel Switchboard

The 1,500-volt direct current switchboard possesses a novel feature in that it is mounted flush with the wall, a recess being provided in order to give access to the back of the board. Another feature of the board is that all the instruments are mounted behind the panel and are viewed through plate-glass windows. The circuit breakers also are mounted on framework behind the board and operated through insulated rods, which arrangement effectively prevents the operator from coming in contact with the 1,500-volt conductors. The feeders for the D.C. system leave the building from behind the D.C. switchboard, lightning arresters being provided on each feeder.

The current supplied to the trains is conveyed by a hard-drawn copper trolley wire. This wire is not fixed directly to the supporters as is the case with tramway overhead wires, but is carried by another wire of stranded copper, technically known as a "catenary" wire. Catenary in mathematics is the curve taken up by a uniform flexible chain or wire suspended from two points and hanging freely between them under no other influence than that of its own weight. When such a chain or wire is made to carry a load it assumes a special form of catenary varying with the distribution of weight. The supporting chains of a suspension bridge, for instance, hang in a parabola. Carrying

a live wire by means of a catenary wire has the effect of making the bow trolley run steadily and evenly along the wire without jumping.

The catenary wire is carried on double porcelain insulators mounted on steel bracket arms carried by steel poles. The rails of the running track are bonded in the usual manner in order to ensure electrical continuity for the return circuit.



[Courtesy] [The English Electric Co. Ltd.

Freight Coach to carry 10 Tons

British-Built Passenger Coaches

The bodies of the passenger coaches, one of which is shown in our illustration, were built by the Midland Railway Carriage and Wagon Co. Ltd., of Birmingham the bogies and electrical equipment being made at The English Electric Company's Works at Preston. The principal details of these coaches are as follows :—

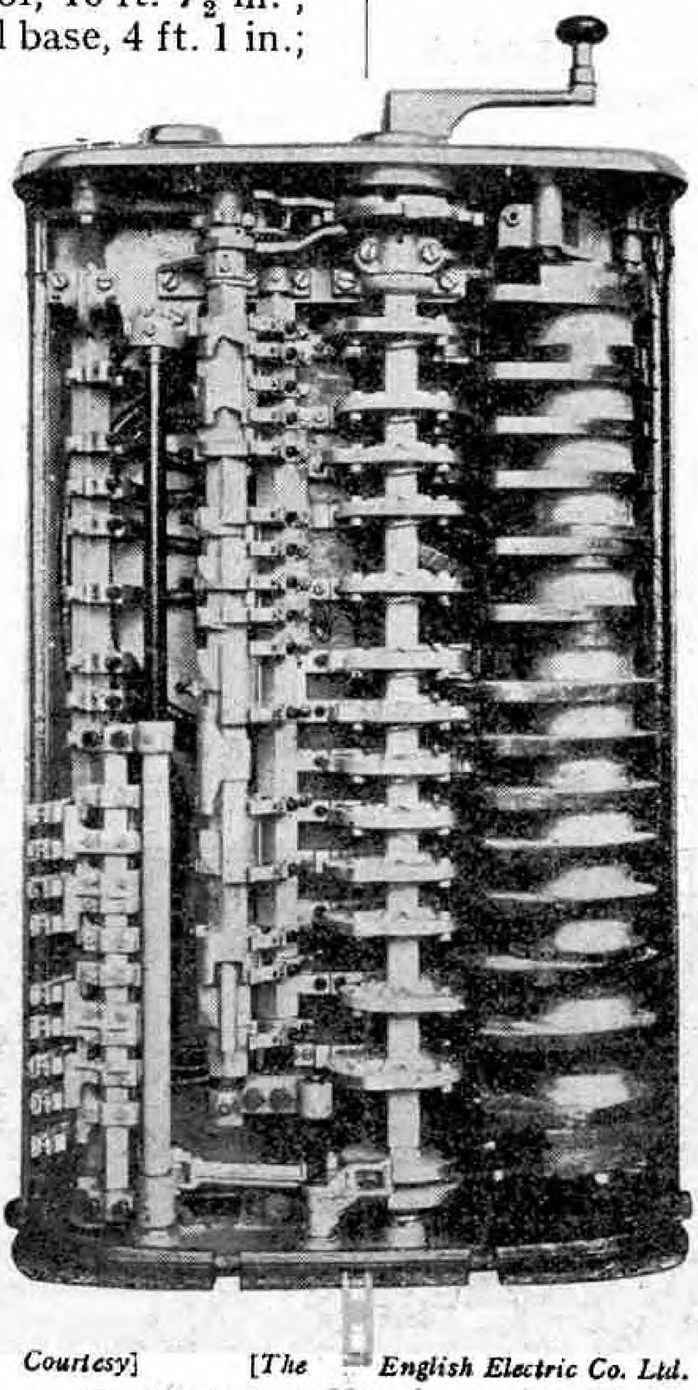
Length over body, 49 ft. 4 in.; width over body, 7 ft. 9 in.; height from rail to top of roof, 10 ft. 7½ in.; centres of bogies, 35 ft. 4 in.; bogie wheel base, 4 ft. 1 in.; height from rail to centre of coupler 2 ft. 5½ in.; length of each passenger compartment, 13 ft. 6½ in.; weight on rail complete, 23 tons 3 cwt.; rail gauge, 3 ft. 3⅜ in.

The cars are constructed throughout of pitch pine, the inside sheeting being varnished in the natural colour and the ceiling painted white. Each car has seating accommodation for 40 passengers and consists of two separate compartments fitted with reversible seats, two lavatory compartments, one luggage compartment and a driver's compartment at each end.

The underframes and bogies are of steel, the centre couplers being of standard American type. The coaches are provided with cow-catchers of substantial construction and a powerful headlight is fitted at each end of the coach.

Special Braking System

The electrical equipment consists of four "English Electric" 60 h.p. traction motors each wound for 750 volts and running two in permanent series. Current is collected from the overhead line by means of bow trolleys, and an interesting feature of the control is that it is effected directly by the motorman's controller and not by means of a master controller and contactors. This is a new development for such a high line voltage as 1,500, and one of its advantages is that it avoids complications in the shape of a number of contactors and relays. Our illustration shows one of the controllers with the cover removed and the metallic shield blow-out in position.



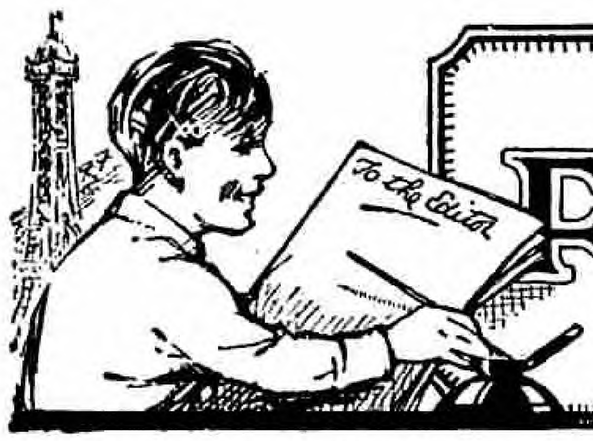
[Courtesy] [The English Electric Co. Ltd.

Controller with Cover Removed

It has already been mentioned that the line rises to a height of 6,000 ft. in the short distance of 30 miles, and it includes long ten per cent. gradients. It is easy to understand therefore that particular care had to be taken in regard to the braking installation. The normal service brake for the long gradient is the rheostatic brake, the main motors being made to act as generators loaded on to the resistances mounted beneath the car. For the purpose of bringing the train to a standstill on the gradient or elsewhere a powerful straight air-brake is provided, the compressed air for which is supplied from a compressor driven by a motor running on the full line voltage. A hand brake is provided for holding the car, and for emergency use, in the event of the wheels slipping on greasy track, magnetic track brakes energised from the 1,500-volt line are fitted.

One of the freight coaches is shown in the photograph on this page. These coaches carry a load of 10 tons and their electrical equipment is exactly the same as that of the passenger coaches.

The Campos do Jordão scheme is interesting as affording an excellent example of modern electric railway practice. In this country electric traction has been confined so far to comparatively short stretches of line, but if ever main line electric traction does develop it is probable that the system adopted will be similar to the one described in this article.

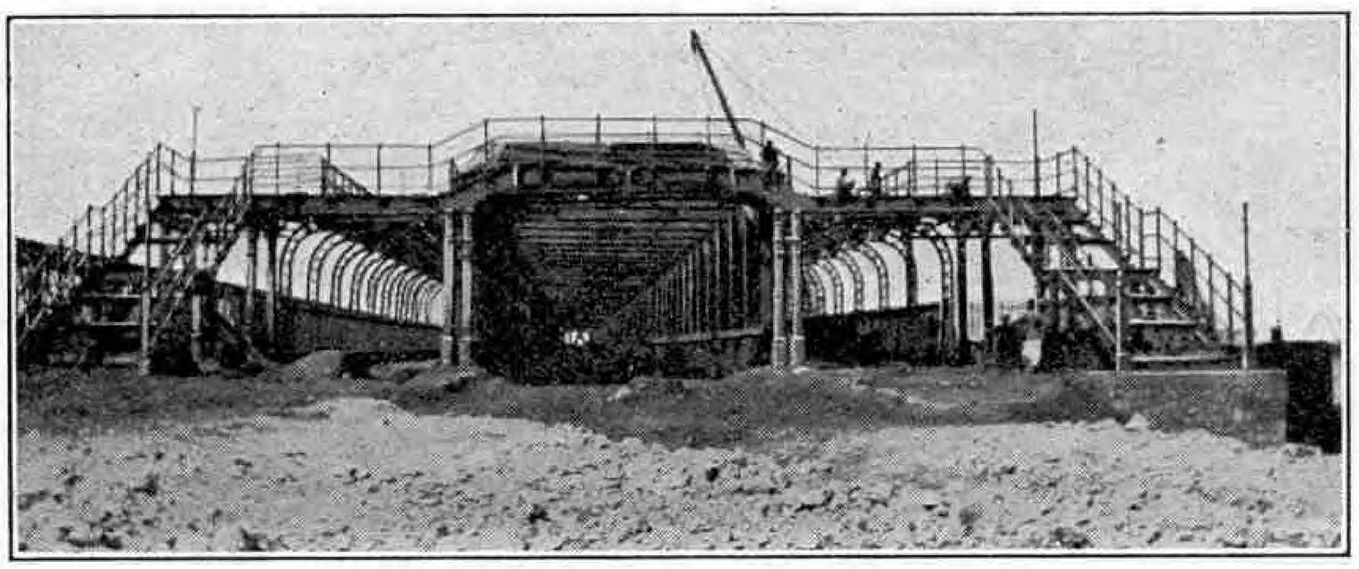


FROM OUR READERS

This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for this page are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

The Enbabah Railway Bridge

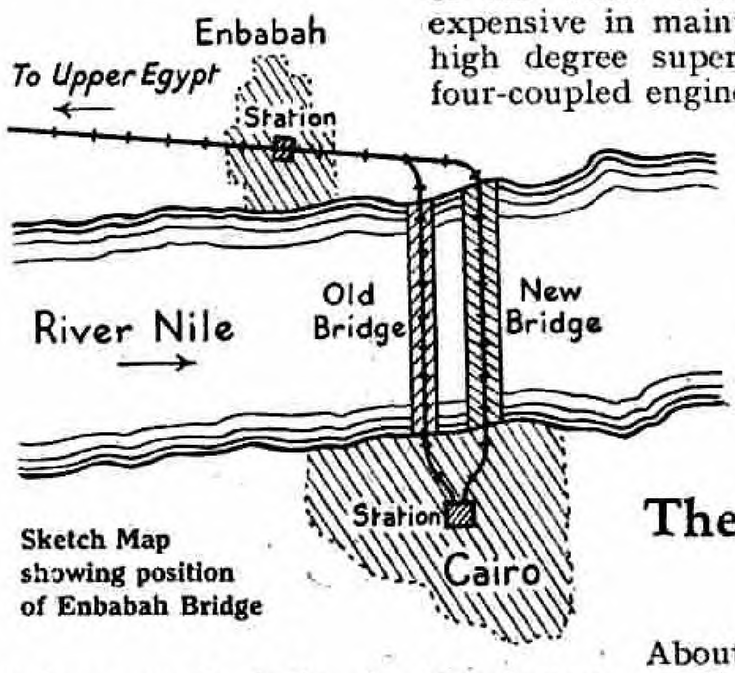
When railways were introduced into Egypt and the Upper Egypt line was planned, a bridge was erected across the Nile from Cairo on the eastern bank to Enbabah on the western bank. The importance of this bridge lay in the fact that most of the towns and villages of Upper Egypt are situated on the western bank of the Nile. After some years the bridge became incapable of dealing with the increased traffic. It contained a single line of railway track in the centre and on each side of this there was a path for vehicles with two platforms for foot passengers. Light motor cars were allowed to pass over the bridge if they had a licence from the Ministry of Communications, but lorries and big cars were not allowed to cross.



The Bridge during construction. The tracks are not yet laid and painters are at work

It was obvious that a new and wider bridge was necessary and in 1912 work was begun on the new Enbabah bridge. Work was interrupted by the Great War but was resumed in 1919, and the structure will shortly be completed. The old bridge will then be taken down and re-erected at some other point on the Nile.

The bridge has a clear span of 500 metres (547 yds.) and is composed of eight sections resting on eight abutments, including the great round one on which the revolving section turns when the bridge is opened for ships to pass. The bridge is 20 metres (22 yds.) wide and has two decks. The lower deck is divided into three roads. The central division contains a double track for the railway, on each side of which are wide paved roads, suitable for every kind of traffic. Pedestrians are not allowed to pass over the lower deck, but there is a special road provided for them on the upper deck, which is reached by means of staircases at each end of the bridge. The total weight of the bridge is 15,000 tons. The revolving section is turned by means of two perpendicular shafts connected with suitable gearing at the base, each shaft being turned by four men.



Sketch Map showing position of Enbabah Bridge

The bridge has a very impressive appearance and is rightly regarded as a very fine engineering work.

The River Nile, upon which the fertility of Egypt depends, extends for over 4,000 miles from its source to the sea. For centuries the means of irrigation in Egypt were exceedingly primitive, but during recent years British engineers have taken matters in hand and by means of such gigantic works as the Assouan and Sennar dams have harnessed the Nile to such an extent that the productivity of the land has increased enormously.

ALY. A. SHAWKY (Cairo).



Our contributor, Mr. A. A. Shawky, of Cairo, at the entrance of the Bridge

A Favourite Loco

In the South West of England, and at Eastleigh in particular, there are many admirers of Loco No. 463. This loco was the first of ten large 4–4–0 type express engines weighing with tender 108 tons, introduced by the late Mr. Dugald Drummond for the L. & S.W.R. I think I am right in saying that they were originally intended to handle the first dining car trains to be used on the Waterloo to Portsmouth line, and inaugurated about 1911. It was not for many years after this that these and other heavy engines worked this section, as they proved too heavy for the road in the condition in which it then was, and also were far too useful not to be used on the main line.

When these locos were built they embodied many unusual features. They had a working pressure of 200 lb. per sq. in. (later reduced to 180 lb. per sq. in.), water tube fire box, feed-water heating to a high degree, duplex pumps, steam dryer, inside Walschaerts gear, steam reversing gear and piston valves. Mr. Urie later increased their efficiency by the removal of the water tubes and pumps which unfortunately were too expensive in maintenance. The smoke-box was extended and a high degree superheater added. In my opinion there are no four-coupled engines to compete with these in appearance. They also are capable of exceptionally high speed and smooth running.

I believe it was Mr. Drummond's intention to equip 100 South Western engines with hooters—something similar to the Caledonian Railway. I was told that there had been so many complaints from residents near the railway that No. 463 was the only one so fitted!

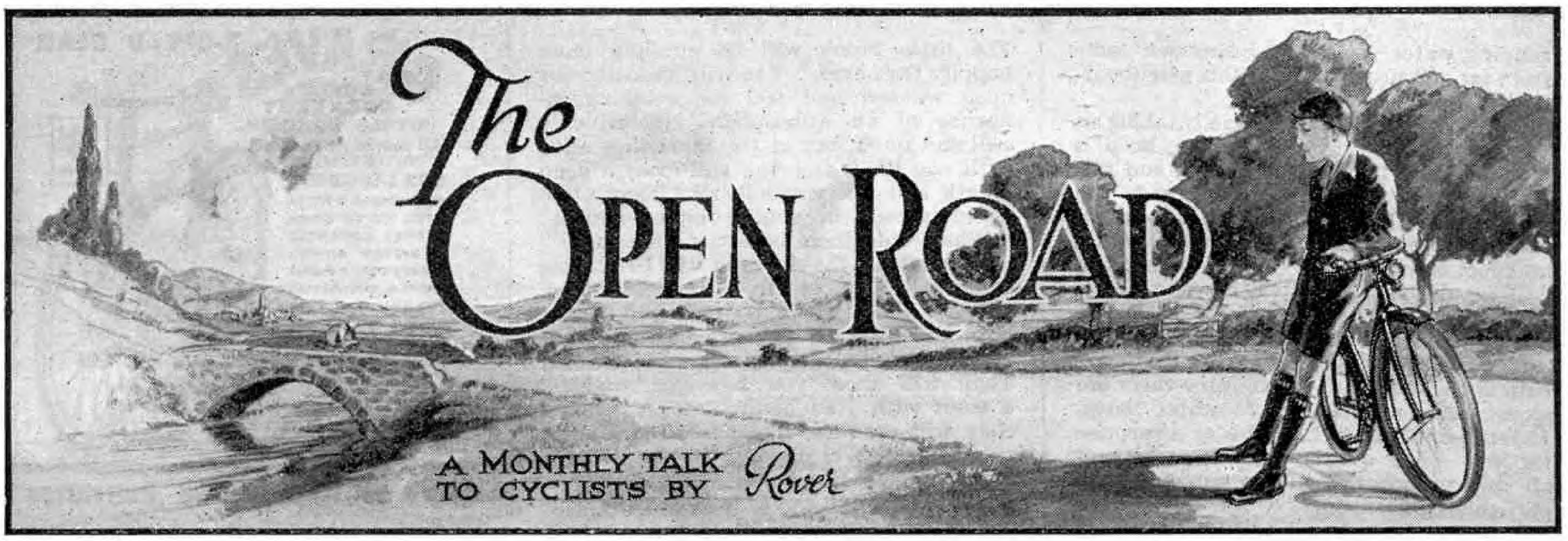
"ONCE A S.W. APPRENTICE."

The Clyde End of the Forth and Clyde Canal

About four miles from where I live is the Clyde end of this famous canal, and since my father works there I occasionally take a walk out. First I come to the harbour and inspect the many ships there, especially the steamers that ply between Glasgow and Rothesay in the summer and lie in the harbour in the winter. In one corner there is a ship called the "Rask," an old four-masted wind-jammer which was an American whisky-runner but was caught and the crew sent to prison.

From the harbour the boats are raised by a lock to the upper basin. They then pass below two bridges, the first a 500-ton steel bridge carrying the L.M.S. line. The bridges are controlled from the signal cabin and I have had the privilege of seeing how the mechanism operates. It is worked by hydraulic power and when I was told so I thought of Bramah.

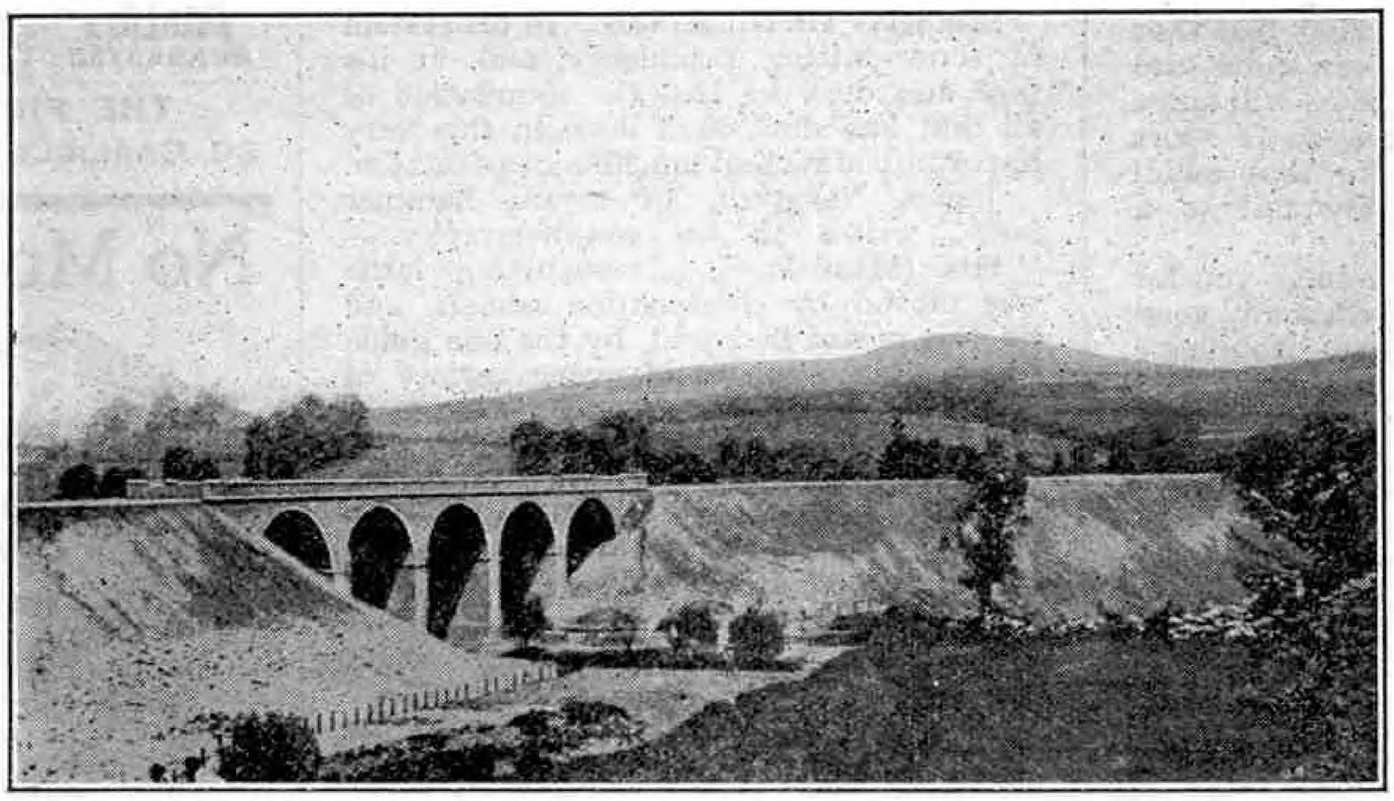
W. WILLETT (Dumbarton).



IV. TOUR THROUGH SOMERSET AND DEVON: A HISTORIC BATTLE

THE beauties of Glastonbury tempt us to linger, but we must not forget the miles that still remain to be covered. You don't want to go yet? Well, we'll just stop for five minutes at this gate and let it all soak in. While you listen to that blackbird I am going to try and stare out of countenance that "cow de luxe!"

We've actually been here a quarter of an hour! Now for Somerton. We have quite a nice little coast ahead—nearly a mile I should say—and as we are sailing down notice the viaduct over the valley. The Somerset and Dorset Railway crosses our route here and we dive under the bridge and circle right round so that at the bottom we see all this part from the other side of the viaduct—quite a big turn.



Somerton Viaduct

About a mile from here is the scene of the Battle of Sedgemoor, where the Duke of Monmouth was finally defeated in 1685. Monmouth is one of the most tragic figures in English history. He was born in Holland in 1649 and was regarded and treated by many as a prince of royal blood, although his claims were never established. At the age of 13 he was sent for by Charles II. and came under the worst influences of the court. He was created Duke of Monmouth in 1663, and two years later he married Ann Scott, a daughter of the Earl of Buccleuch, and the wealthiest heiress of Scotland. He took an active part in fighting both on land and sea and showed that he was not by any means without courage.

A few years later, with the probability of the accession to the throne of James, the anti-popery spirit became serious. Monmouth was pushed forward as "the Protestant Duke" and efforts were made, without success, to persuade Charles to declare Monmouth his son. When James II. came to the throne Monmouth was in Holland where he had fled to avoid the consequences of his plotting. The Duke of Argyll and many other prominent Protestants were also in exile and they persuaded Monmouth to lead an invasion of England.

He landed at Lyme Regis on 11th June 1685, gathered a rough army of 1,500 men and seized Taunton. He then marched to attack Bristol, but this attempt failed. On Sunday, 5th July, 1685, his forces were overtaken by Lord Feversham's troops at Sedgemoor. Monmouth attempted a surprise attack in the darkness, but his forces were completely routed and he fled over the Mendip Hills to the New Forest, hoping to reach the coast and escape by sea. Three days later he was captured, however, and taken to the Tower of London where, in spite of personal prayers to the King for mercy, he was executed on 15th July, 1685, at the age of 36.

Following upon the failure of Monmouth, the West Country was dotted with scaffolds as the notorious Judge Jeffreys mercilessly dealt with all suspected persons. No less than 320 executions for high treason were ordered by this blood-thirsty monster, and the lovely country through which we are now passing was indeed a land of terror.

Here is the most interesting thing in Somerton, the old Market Cross. This dates back to 1670, but it looks far older than it really is.

And now we are on the way to Langport, five miles distant, and fortunately the riding is good. We might have had tea in Somerton, but it is really too early, and by the time we get to Langport we shall be even more ready to do justice to a meal.

Now we come in sight of Langport and I am glad to see you have not failed to note the Church towers. These are a very striking feature in this county and one writer very appropriately calls them "Somerset's Glory." Nearly every tower carries a peal of six or eight bells and in every village you will find most enthusiastic bell ringers.

This then is the town, and we must go steady along this narrow street which looks as if it had been made narrow on purpose just to produce this right-angle turn! We cannot do better than stop at this shop. They know me well here on account of my frequent trips this way and so I am always received as an old friend. On one occasion it was a particularly hot day, and I suppose I was looking pretty fagged. At any rate "mine host" offered to drive me the remainder of my journey. I didn't accept, and it rather puzzled him to think that I should prefer my old bike to a comfortable seat in his dog-cart. But all the same you may imagine that I greatly appreciated the kindly spirit that prompted him to make the offer.

We will have a "swill" while they are getting things ready for us. It is surprising how grimy one gets on a hot, dusty day and a wash will freshen us up wonderfully.

That was a real country tea, wasn't it? We will loaf about a little while to recover from the effects before we resume our journey. In many ways this time of day is splendid for riding. The sun is getting lower and the air is soft and balmy. and you will find when we start again that you are more in sympathy with your machine than at any previous time of the day. You get as it were your "second wind" and you simply revel in the going.

We will walk a little distance and pause for a while at this bridge that crosses the river Parritt. It is very fascinating to look down into the clear

running water, isn't it? Fishermen come from far and near to fish in this neighbourhood.

We are again on a road that is taking us to Taunton. Now we have to keep a look-out for a turning on our left, and this will be the first time we have seen the name of our day's destination appear on the signpost. This little fact has quite an effect on one's spirits, and I expect you will be quite excited when you see it. There it is!—"12 miles to Chard." We do not go quite into Chard, however.

You will be interested to know that even here in the depths of the country there are scores of enthusiastic Meccano boys. In fact—and I have kept this as a surprise for you—your quarters for to-night and all day to-morrow will be among some particularly keen ones.

I expect that when I call for you early on Monday morning to resume our tour you will be very reluctant to leave. However, I know you will appreciate the day's rest, for although we have ridden carefully to-day you are certain to feel stiff in the morning. You need not be alarmed at that prospect, however. Did you not feel somewhat "disconnected" after your first day's cricket this season, and have you forgotten what a bruised and swollen object you felt the day after your first "footer" match last year? Well, you won't have anything like that to get over. In any case I am quite sure that you, like all Meccano boys, will agree that the fatigue felt after a day's sport of any kind is preferable to that awful slack feeling that inevitably follows a day's "loafing."

And now I am going to indulge you for a short time and we will have a really good spin. There! Wasn't that topping? We did pretty near five miles in splendid time and now we can afford to dawdle along. Yonder is Ilminster and here, quite close, is the Taunton-Chard road. We follow that for a short distance and then turn into one of those rough-looking lanes you see on our right. The loose flint stones are not ideal for cycling but we shall walk a good part of the way now and you will find very little cause for complaint. Lanes with hedges such as these are quite charming for rambles, as you will find out to-morrow.

Now let me describe to you the cottage we are approaching and which you will make your home until Monday morning. It stands on the side of a hill, a little apart from the village, right in the middle of a large garden. It is a very old but strongly built house which has been added to and improved from time to time so that it is now entirely up to date. Over the garden gate and over the porch are archways of roses—indeed there are roses everywhere and of all varieties. I cannot attempt to describe the flowers you will find in that garden, it is simply a profusion of colours.

A little gurgling brook runs down one side of it, and as we come to the end of the garden a small gate gives entrance to an orchard which by now will have a good number of apples, showing promise of a splendid yield later. The inside of the house is just as entrancing as the outside and you will find it wonderfully cool and restful after your ride.

When you wake in the morning you will wonder what is amiss. The contrast to the town is amazing. You will hear the breeze gently rustling the trees near your window and the birds warbling and twittering away musically and unceasingly. The little brook will be gurgling more happily than ever. You will stand at your open window and feel the soothing influence of an atmosphere indescribably still and quiet, yet at the same time alive with *real* life; and you will draw a deep breath and ask yourself, as I have often asked myself in similar circumstances: "What could there be better than this?"

Throughout the day you will be coming continually across fresh delights and, unless I am very much mistaken in the boys who will be your companions, there is very little you will be allowed to miss. They will show you how to "tickle" a trout with your hands and on demand they will produce, like conjurors, almost any particular bird's nest or wild flower!

Here come the young beggars themselves! I am not going to waste any time on introductions, so off you go. Don't get into *too* much mischief and don't forget that postcard to the "Mater," or she'll be anxious. You'll sleep like a top to-night!

(To be continued)

Lives of Famous Engineers—

(*Continued from page* 499)

machines were taken to pieces for repairs caused an enormous amount of trouble, and to avoid this it was the practice to mark carefully each bolt and its corresponding nut.

Maudslay altered all this. In his system of screw-cutting machinery, and in his taps and dies, he laid the foundation of all that has since been done in this very important branch of machine construction.

James Nasmyth, of steam hammer fame, writes in his autobiography:—"His (Maudslay's) screw-cutting lathe was moved by combination wheels, and by this means he could, by the one guide screw, obtain screws of every variety of pitch and diameter. As an illustration of its complete accuracy I may mention that by its means a screw of 5 ft. in length and 2 in. in diameter was cut with fifty threads to the inch; the nut to fit on to it being twelve inches long, and containing six hundred threads! This screw was principally used for dividing scales for astronomical and other metrical purposes of the highest class. By its means divisions were produced with such minuteness that they could only be made visual by a microscope."

In January 1831 Maudslay contracted a chill on his return from a visit to France and after three or four weeks' illness he died on 14th February. He was buried, as he directed, in Woolwich Churchyard, where a cast iron tomb, made to his own design, was erected over his remains. He had begun his life as a mechanic at Woolwich and it was natural that he should wish to be buried there, near the clamour of the Arsenal smithy where he first learned his art.

Maudslay was a man of commanding presence, standing 6 ft. 2 in. in height and of massive proportions. His face was almost invariably lighted up with good humour and his general expression was always of great life and energy. His cheery manner set everybody at ease and all those who entered into business relations with him felt from the first absolute confidence in his integrity.

NEXT MONTH:—

NASMYTH,
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How to Start an Aquarium—

(*Continued from page* 521)

be inflicted upon even a fish.

It must not be imagined that because the ditch and pond dwellers live together they are all friendly disposed towards each other. This is far from the case, and if we could see the struggle for existence that goes on in every peaceful-looking pond, we should be greatly surprised at the tragedies enacted there.

In their natural habitat the weaker species can find some shelter and protection from the more aggressive members of the community, and in the plant life of their home or in the muddy bottom, or among the stones, they have a chance to escape from their hungry pursuers. In an aquarium this is not possible, hence we have to use a wise discretion in the selection of the species to be associated in our tank.

The Stickleback is a most interesting creature, but for voracity and pugnacity it is difficult to find its match. The Stickleback should never be introduced where there are more delicate and peacefully-disposed occupants—in such a case it is safer to keep them in a separate vessel. Having prepared the tank as previously described, planted and established the various water-weeds, introduced the water-snails and as much minute pond life as possible (water-fleas, cyclops, etc.), we may proceed to instal our Sticklebacks. There should be one male to four or five females. In the spring it will be easy to recognise the male, his breast then assuming a courting colour of bright iridescent red, and at this time he will fight his male rivals with great tenacity and fierceness, raising his spines and fiercely darting at his foe.

If the tank be well provided with plant life, thus affording the necessary material for nest building, the Stickleback will proceed with this interesting part of his domestic affairs. With fibres from the plants he will construct a muff-like nest, hollow in the centre. When this is completed he entices one of the females to view his work, enter the tubular nest and deposit her eggs. No sooner is this accomplished than it is a case of "off with the old love—on with the new!" He flaunts his coloured vest and with sundry fishy wiles persuades other willing females to add to the number of eggs deposited.

Mr. Stickleback then completely ignores his wives, enters the nest and busies himself in "fanning" the water with his fins in order that it may circulate through the nest, flow and ripple over the eggs, and thus aid their incubation. With the appearance of the young fry his life becomes more arduous still, for they must be protected even from his discarded wives, who have decided cannibalistic instincts which they are not slow to put into operation!

If it is desired to witness nest-building operations, the fishes should be obtained not later than the middle of April, and there should be no disturbing the fishes and plants in a manner likely to upset them after they have been introduced to their new home.

The natural food of the Stickleback is the minute pond life and the small fry of any species of fish and in confinement these little gourmands must be well fed. Small worms—first dashed upon the pavement to kill them—pieces of larger worms, shreds of raw meat, etc. form very suitable food.

The Stickleback is not a long-lived fish in confinement, rarely surviving more than three years. The writer returns them to his garden pond at the end of each season and for the autumn and winter re-stocks his tank with the Golden Orfe, Carp, Minnows, etc., which have been given a summer holiday in the garden pond.

NEXT MONTH:—

POND LIFE

Aluminium—(*continued from page* 511).

The ore now passes through a final grinding and is then ready to undergo the main process in which the alumina is separated out. This stage of the operations is now almost universally carried out by what is known as the "Bayer" process. The calcined ore is mixed with a certain quantity of a solution of caustic soda and is then transferred to "autoclaves" which are long steel containers provided with steam jackets and stirring apparatus. The heating of the fluid by the surrounding steam produces a pressure of about 70 lb. to the square inch. Chemical re-action takes place, resulting in the formation of soluble sodium aluminate, whereas the impurities remain as an insoluble residue.

The liquor from the autociaves is now blown out by the force of the internal pressure into large tanks, where it is diluted with washings from previous operations and then filtered in presses. The clear liquor is then stirred with aluminium hydrate. This results in the precipitation of a large proportion of the dissolved alumina as hydrate, which is separated in filter presses, washed and dried. Finally it is heated in a rotary kiln to a temperature of 1000°C., and in this operation the alumina is transformed from amorphous to crystalline formation.

Electrolytic Reduction

The pure alumina thus obtained must now undergo further treatment in an electric furnace to reduce it to aluminium metal. The only process in use at the present time for this purpose is the Héroult-Hall process, which was introduced in 1890. A current of from 2,000 to 20,000 amperes at 5 to 8 volts is used.

The process really consists of electrolysis carried out at a very high temperature. The current plays a two-fold part, acting as a heating agent to keep the electrolyte in a state of fusion while at the same time it deposits aluminium metal at the cathode electrode. The electrolyte is formed by dissolving alumina in molten cryolite, and in passing through this the current decomposes the alumina into aluminium and oxygen. The oxygen attacks the carbon electrodes forming carbon dioxide and this results in heavy electrode consumption—a serious item in the cost of the process.

The molten aluminium is tapped off at intervals of two or three days, according to the size of the furnace, and is afterwards re-melted in a reverberatory furnace and cast into ingots, slabs or bars as may be required. The average yield of metal is 1 lb. for every 2 lb. of alumina.

Hydro-Electric Power

The electrolytic production of aluminium requires a great deal of current and therefore a cheap and ample source of power must be available. The cheapest source of power is water, and the aluminium industry has concentrated itself in areas where water power is abundant. The British Aluminium Company Ltd., for instance, have extensive aluminium reduction works at Kinlochleven in Scotland, and have carried out hydro-electric developments on a huge scale in order to supply the necessary current. This company produces refined alumina at Larne Harbour, Co. Antrim, Ireland, and at Burntisland, Fifeshire, Scotland, and has also power and reduction plant schemes in Switzerland and Norway.

In the same way throughout the world we find that hydro-electric power is utilised for the production of aluminium.

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VII. COLOUR-CORRECT PHOTOGRAPHY

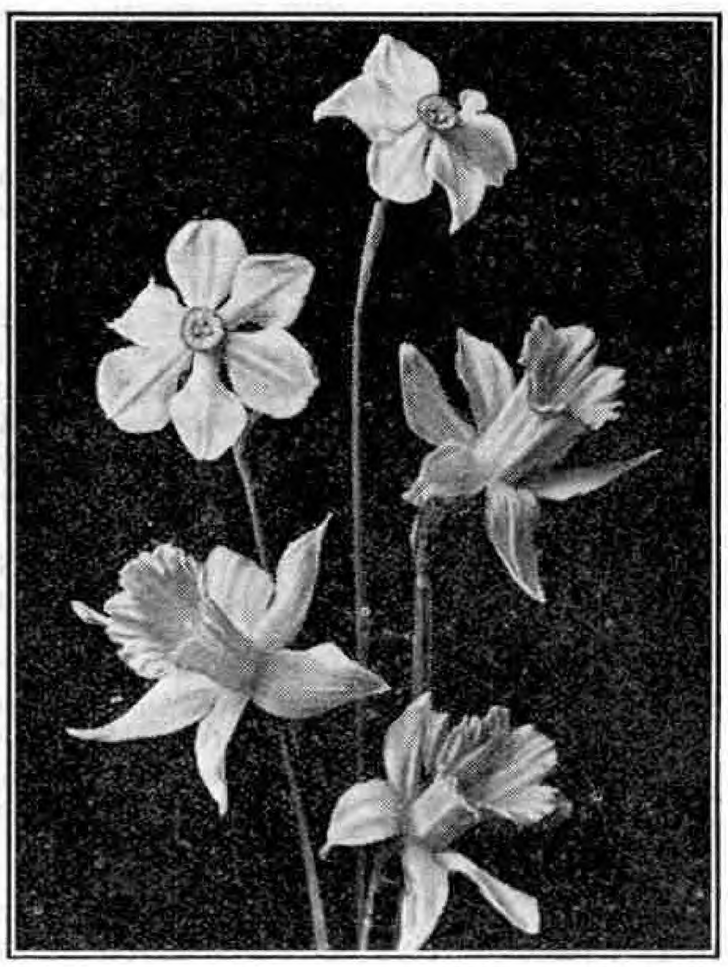
IN our August issue we referred to the use of plates of special colour sensitiveness for the purpose of obtaining clouds and landscape on the same negative. The great value of these plates lies in their power to respond to colours to which the ordinary plate is largely blind.

Some of the earliest experimenters in photography observed that the sensitive material they prepared was not affected equally by light of every colour. In 1873, Professor H. W. Vogel, of Berlin, found that, by adding certain dyes to the sensitive emulsion on the plate, this could be made to respond to colours to which previously it had been practically insensitive. This discovery was the foundation of the wonderful colour-correct photography of to-day, and also of three-colour and other processes for the purpose of producing photographs in the actual colours of nature.

The difficulty in regard to the ordinary photographic plate lies in the fact that it does not respond to colours to the same extent or in the same proportion as the human eye. For instance, to the eye yellow is the brightest of all colours, and yet in a photograph on an ordinary plate a yellow object appears quite dark. A pure red, which to the eye is quite brilliant, is reproduced as black by the ordinary plate ; green appears darker than it should do, whereas blue, on the other hand, is rendered too light, an intense blue photographing almost like white. The trouble is further complicated by the fact that white light contains ultra-violet rays that are invisible to the eye, but which are intensely active towards the photographic plate.



Photos courtesy] **Negative on Ordinary Plate**



[*Messrs. Ilford Ltd.* **Negative on Screened Chromatic Plate**

The colour-blindness of the ordinary plate may be demonstrated quite easily. Place an orange on a black cloth and photograph it on such a plate. The result is almost startling. To the eye the orange stands out brilliantly in contrast to the black cloth, but in the photograph it appears almost as dark as the cloth itself. This is an extreme case, but it serves to show that the ordinary plate cannot give a correctly proportioned rendering of any landscape or collection of objects in which the colours blue, green, yellow and red are included. Since every landscape contains these colours it follows that all photographs taken on an ordinary plate are incorrect as regards colour values.

This defect of the ordinary plate is remedied by a process of " orthochromatizing." Such plates are known as " isochromatic " or " orthochromatic," the former word meaning " equal in colour " and the latter " correct in colour." These two long words are frequently abbreviated to " iso " and " ortho," and different makers have different names for their special brands of plates.

Orthochromatizing consists in treating the sensitive emulsion with certain anilin dyes that have the effect of increasing sensitiveness in regard to greens and yellows. A great improvement in the plate is obtained in this manner, but the emulsion is still far more sensitive to blue and violet than it is to yellow and green. This difficulty is surmounted by interposing a yellow screen, which filters out some of the light to which the plate

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is abnormally sensitive. In order to obtain the best results it is necessary that the yellow screen or light filter should be adjusted to the plate, so that it may filter out exactly the correct amount of light to make up for the deficiencies in the emulsion. Screens for this purpose are made in various forms and may be obtained in many different sizes and fittings.

The fact that the colour screen stops some of the light to which the plate is sensitive necessitates a proportionate increase in exposure. Colour screens are described as being "four times," "six times," or "ten times" screens to indicate that, when they are used, the exposure that would be correct without a screen must be multiplied by four, six or ten respectively. This increase in exposure is a serious drawback to the use of colour screens in hand-camera photography. In many cases a screen that requires three or four times the normal exposure may be used successfully, but frequently, owing to the speed of movement of the object to be photographed, or the poor light, the use of even a "three times" screen is impossible.

Plate manufacturers have done a good deal to overcome this difficulty by producing plates that have a yellow screen incorporated in the emulsion itself. Such plates are variously known as "Screened Chromatic," "Self Filter," "Anti-Screen," "Filtered Ortho," etc., according to the particular fancy of the manufacturer. The results obtained from such plates are equivalent to those resulting from the combination of an orthochromatic plate and a pale screen, and for many purposes they undoubtedly give very much better results than an ortho plate used without a screen. These "self-screen" plates are made of very high speeds and can be used for any purpose for which an ordinary plate is used.

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The advantage to be gained by the use of plates containing their own screen is well illustrated by the two photographs on page 528. The subject consists of Narcissi and Daffodils. The left-hand picture is a print from a photograph on an ordinary plate and it will be seen that the Daffodils, which would appear very brilliant to the eye, are far too dark and utterly out of proportion to the Narcissi. The right-hand picture is a print from a negative taken on an Ilford Screened Chromatic plate and it will be seen that the difference is very striking. The brilliant yellow of the Daffodils is now clearly indicated and the proportionate colour values of the two kinds of flowers are excellently represented.

Orthochromatic plates go a long way towards solving the problem of colour-correct photography, but such plates are still insensitive to red. The effort to make a plate that should be sensitive to all the colours that together form white light has resulted in the production of what are called "Panchromatic" plates. Like orthochromatic plates, panchromatic plates are prepared by the use of anilin dyes. The process of manufacture consists in bathing finished ordinary plates in a solution of the dye, or in adding the dye to the liquid gelatine and bromide of silver emulsion before putting it upon the plate. In either case the subsequent operations of drying, examining and packing the plates are conducted in almost total darkness.

Panchromatic plates do not give correct colour rendering without a colour screen, but if the screen is carefully adjusted to the plate the resulting photographs will render colour values exactly as they are seen by the human eye. The only disadvantage of panchromatic plates is that, as they are sensitive to light of all colours, they must be handled in almost total darkness. Results that are little short of marvellous can be obtained by the use of panchromatic plates in the photography of furniture, carpets, pictures, etc., and we hope to return to this interesting subject later.

The improvement in rendering obtained by the use of orthochromatic plates with a screen, or of self-screened plates, is very remarkable. This is particularly the case in regard to the representation of sunlight effects, in which the ordinary plate is seriously deficient. Cloud effects may be obtained with little difficulty, and the general appearance of a landscape is much more natural. The use of ortho plates in the photography of flowers is obvious, and the amateur who goes in for portraiture will find that these plates are of great assistance, particularly in regard to sitters having blue eyes or hair that is inclined to be red.

It might be thought that the ortho plate would be no better than the ordinary colour-blind plate for the photography of snow scenes, but as a matter of fact the ortho plate is vastly superior for such work. Not only does it give a truthful rendering of sunshine, but shadows across the snow are beautifully reproduced, and the sky, instead of appearing a blank white, is shown in true relation to the brilliance of the snow-clad earth.

(*Continued on page* 515)

Competition Corner

"Seven Modern Engineering Wonders of the World"

VOTING COMPETITION

Last April we adopted one of the proposals submitted in the previous "Suggestions" competition and announced as the subject of our essay contest for that month: "The Seven Modern Engineering Wonders of the World."

The competition was a great success, popular alike with Home and Overseas readers, and an immense number and variety of great engineering works were claimed by our readers to be worthy of a place among the first seven.

In announcing the essay competition we promised to organize a voting competition at a later date to determine the first seven wonders in the opinion of the majority of our readers. We print below a list selected from the essays sent in for the April contest and upon this list we base the promised Voting Competition.

All that competitors have to do is to send in on a post-card the seven items from the list which they regard as the "Seven Modern Engineering Wonders of the World." When the closing date arrives each entry will be carefully examined and the seven items selected by the majority of our readers will be determined.

Prizes of Meccano goods to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors whose lists agree most closely with the result of the total vote.

Competitors may submit more than one entry. Post cards must be addressed "Voting Competition, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than 31st October (Overseas, 28th February, 1926).

The following is the list from which the seven items are to be selected:—

Canadian Pacific Railway
H.M.S. "*Hood*"
Assouan Dam, Egypt
"R.33"
Eiffel Tower
London Tube Railways
Forth Bridge
Ford Motor-car
Panama Canal
Rotor Ship
Admiralty Harbour, Dover
Wembley
Britannia Tubular Bridge, Anglesey
R.M.S. "*Majestic*"
Waterloo Station, London
H.M. Submarine "XI"
A Whippet Tank
Severn Tunnel
L.N.E.R. Loco "*Flying Scotsman*"
Quebec Bridge
Simplon Tunnel
Niagara Electric Power Station

(*No significance is attached to the order of this list*).

10th Drawing Competition

In recent Drawing Competitions we have had as subjects in turn, locomotives, steamships, sailing ships, tramcars and petrol and steam wagons. Continuing our round of the various means of transport, we announce as the subject of our 10th Drawing Contest: "AN AEROPLANE ON THE GROUND."

There must be very few readers of the "*M.M.*" who have not at some time or other been able to examine at close quarters an aeroplane as it rested on the ground either before or after a flight. It is at this time that the details of these wonderful machines can be studied most thoroughly. Any type of aeroplane may be selected for the subject of a drawing.

Competitors may submit more than one drawing if desired, but each must be clearly marked on the back with the name, address and age of the entrant. As usual the contest will be divided into two classes—A for those of 16 and over and B for those under 16. Drawing or Painting Materials (or Meccano Products), to be selected by the winners, to the value of 10/6 and 5/– respectively, will be awarded to the entries placed first and second in each class.

We wish to remind competitors who desire their entries to be returned after judging has taken place that it is not sufficient to enclose stamps only. A stamped addressed envelope of suitable size is also necessary.

Closing date 30th November. (Overseas, 28th February, 1926).

"Cricket or Football"

During the month of October cricket and football are played side by side, the former bringing its season to a close and the latter vigorously commencing its long winter run. October is therefore a suitable month for comparing the two great national games.

In order to find out our readers' views on this matter we announce this month a competition on the subject: "CRICKET OR FOOTBALL—WHICH GAME I PREFER." Almost all our readers have played both games to some extent and therefore must have a preference for one or the other. In order to enter for this competition all that is necessary is to write a short essay stating which game is preferred and why.

The contest is divided into two classes, A for those over 16 and B for those under 16, and prizes of Meccano goods or Hornby Trains or accessories to the value of £1/1/– and 10/6 will be awarded to the competitors whose essays are judged first and second respectively in each class. A long essay is not necessary. All that is required is an interesting statement of the competitor's opinion and his reasons for it.

Entries must be written on one side of the paper only and the competitor's name, address and age must appear on the back of each sheet used.

Closing date 30th November (Overseas, 28th February, 1926).

Competition Closing Dates:

HOME.	
"My Favourite Loco" Essay	31st October.
Ninth Drawing	31st October.
Nineteenth Photo	31st October.
"Engineering Wonders" Voting	31st October.
"Cricket or Football" Essay	30th November.
Tenth Drawing	30th November.
Twentieth Photo	30th November.
OVERSEAS.	
Seventeenth Photo	30th November.
Seventh Drawing	30th November.
Cricket Voting Contest	30th November.
August (Holiday) Essay	31st December.
Eighth Drawing	31st December.
Eighteenth Photo	31st December.
"My Favourite Loco" Essay	31st January.
Ninth Drawing	31st January.
Nineteenth Photo	31st January.
"Engineering Wonders" Voting	28th February.
"Cricket or Football" Essay	28th February.
Tenth Drawing	28th February.
Twentieth Photo	28th February.

Results

7th Drawing Competition

An unusually big entry was received for this contest, "A Pleasure or Fishing Boat under Sail." These ranged from crude little sketches on scrappy bits of paper to elaborate and beautifully finished drawings that must have involved many hours of painstaking application. The standard of excellence reached by many of the drawings was considerably higher than we had expected and many of the entries that were not quite good enough to gain an award were really excellent.

One criticism may be made in regard to many of the drawings and that is that they were marred by insufficient attention to minor details. In our previous drawing contest—"A Great Passenger Liner"—details such as seagulls or small boats were frequently so much out of proportion as to be grotesque. In the present contest many otherwise excellent drawings were spoiled by figures of boatmen entirely out of proportion to the boat and also carelessly drawn. Many of the passengers in the pleasure boats looked anything but happy, and wore the kind of expression one sees on Isle of Man steamers during a rough crossing!

Awards:–First Prizes (Drawing or Painting materials value 10/6)—Section A, W. H. GLENN (Ipswich); Section B, G. A. BRAYBROOK (Lower Edmonton). Second Prizes (Drawing or Painting materials value 5/–)—Section A, B. G. H. OSBORNE (Winchmore Hill, N.21); Section B, A. LUMLEY (Chelford).

August Puzzle Contest

The three prizes offered in this competition have been awarded as follows:—

Meccano Products to the value of £1/1/–, 10/6 and 5/– respectively to R. W. SELBY (Chard), H. A. FREEMAN (Eastbourne) and F. HERRIOT (Peebles).

Overseas Result

5th Drawing Competition

The entries for this contest were satisfactory in numbers but the standard of excellence fell below that of the Home section. The subject, "A Steam Wagon or Lorry," was one that demanded careful attention to detail and it was in this respect that many of the Overseas entries fell short. No doubt this was due in many cases to the fact that readers living in out-of-the-way parts of the world have few chances of examining one of these vehicles at close quarters, whereas most Home readers see them on the roads day by day.

Prizes of Drawing or Painting materials value 10/6 and 5/– were awarded respectively to S. B. CONNOR (Ontario, Canada) and V. R. HEERAMANECK (Bombay, India).

TWO NEW
MODEL-BUILDING CONTESTS

£25 IN PRIZES FOR A MECCANO LOCO

We devoted a special article last month to a review of the latest Meccano activities in connection with loco-building, and remarked on the increased interest which Meccano boys are taking in this type of model.

With a view to encouraging enterprise and exploiting this new field of Meccano engineering we are announcing a splendid Loco-building Competition, in which nine cash prizes are offered for the three best models of Railway Locomotives built by Meccano boys.

Entries will be divided into the following sections :

SECTION A, for competitors residing in the British Isles ;

SECTION B, for competitors residing outside the British Isles.

Competitors' ages will be taken into consideration when judging the entries.

Prizes will be awarded for the best entries from each section as follows :—

FIRST PRIZE, £5-5s. ; SECOND PRIZE, £3-3s. ; THIRD PRIZE, £1-1s. ; six consolation prizes of 10/6 each.

WHAT YOU HAVE TO DO

The first prize in each section will be awarded to the competitor who sends in the loco that the judges decide to be the best model received in that section, and the second and third prizes will be awarded to the second and third best models.

You may build your loco from any Outfit or number of parts, but it is wise to remember that very often the simplest and most straightforward models are better than complicated models. If you can embody in your model some ingenious use for a Meccano part, or an original movement, this is a distinct advantage that is likely to score more heavily than the most elaborate model submitted.

When you have built your model, you should send in a photograph or a good drawing, together with any explanations you may think necessary, although the latter should be made as brief as possible. Write your name and address only on the back of each sheet used, and state your age, and section in which your model is entered.

Closing date for Section A, 30th November, 1925. Overseas Section, 28th February, 1926.

Mark envelopes "Loco Competition."

Do not send models. A clear photograph or good drawing is all that is necessary.

GREAT OPPORTUNITY for OWNERS of No. 0 OUTFITS

NINE PRIZES FOR SIMPLE MODELS

In this competition prizes are offered for the best models made entirely from a No. 0 Outfit. Models comprising parts that do not appear in this outfit will be disqualified.

This competition offers a splendid opportunity for newcomers to Meccanoland, and to those who refrained from entering previous contests because they did not possess larger outfits.

We hope to receive some very interesting entries in this competition, and we shall endeavour to publish as many of the prize-winning models as possible in next January's "*Meccano Magazine.*" An interesting feature of the contest is the fact that all competitors will be using the same parts.

Entries will be divided into the following sections :—

SECTION A, for boys under 12.

SECTION B, for boys over 12 and under 16.

SECTION C, for boys residing overseas, and not exceeding 16 years of age.

Prizes will be awarded for the three best entries from each section as follows :

FIRST PRIZE : Meccano Goods to the value of £2-2s.

SECOND PRIZE : Meccano Goods to the value of £1-1s.

THIRD PRIZE : Meccano Goods to the value of 10/6.

Closing dates for Sections A and B, 30th November, 1925. Overseas Section, 28th February, 1926.

Mark envelopes "0 Outfit Competition."

Models should not be sent. A clear photograph or good drawing is all that is necessary.

The above competitions are the first of a series that we propose to run through the winter months. Each competition will be arranged on similar lines, with the exception that the class of model involved will continually change. In this way we hope to extend the opportunity of competing to all our readers, whether they possess a No. 0 or a No. 7 Outfit. All the competitions will be complete in themselves, and their results will be announced in the "*Meccano Magazine*" two or three months from the date of the issue in which they appear.

We hope the competitions will result in our being able to publish particulars of many entirely new models which may be built with the smaller outfits, and we cordially invite our readers' co-operation in making this new feature an all-round success.

10/- A WEEK Pocket-Money for a YEAR !

Just think what you could do with a Ten Shilling Note every week. Some boy must win this wonderful prize in the new simple

Picture Competition

in "THE SCOUT," on sale Oct. 15th.

"Fighting to Win"

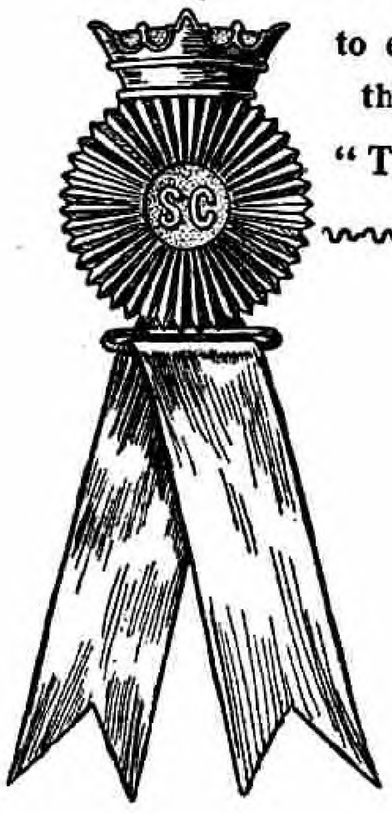
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SCOUT

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BOY HEROES OF THE MONTH

In every community there are boy heroes whose deeds are unknown beyond a small radius. Boys are but men in the early stages and their personal courage does not lose anything by comparison with that of men. Some boys even succeeded in joining the Army during the war by all manner of daring expedients and acquitted themselves like men in France and elsewhere—there were Jack Cornwalls in every branch of the Service.

In time of peace there is no dearth of boy heroism and as opportunity allows I propose to describe on this page any brave deeds that come to my notice. I shall be pleased to receive from readers of the "M.M." descriptions or news cuttings of any such deeds that they consider will be of general interest.—*The Editor.*

Chinese Boy Scout Hero

A 13-year old Chinese Boy Scout, Fred Gsell, a member of the 1st Tientsin Troop, has been awarded posthumously the Bronze Cross of the Boy Scouts' Association for his bravery at a fire at his home. When the fire broke out his father and mother were asleep and Fred immediately raised the alarm. His mother managed to escape by way of the verandah, but his father, overcome by the smoke and fumes, was unable to do so. Rather than escape and leave his father alone to die, the boy stayed with him. By the time the firemen arrived the father was dead. Fred was unconscious and died as he was being taken to hospital.

Boy Scout Honoured

At a grand rally of Boy Scouts and Cubs for the Henfield area, held at Steyning, a West Grinstead Scout, Maurice Freebury, a member of the St. Mary's Troop, was presented with the Silver Cross and certificate awarded him by the Chief Scout for saving life. Last year Freebury and several other boys were in a boat on a pond at Lower Beeding. When the boat was in deep water one of the boys, Eric Morton, was accidentally pushed overboard, and as he could not swim he was in great danger of drowning. Freebury quickly jumped in after him and swam to his assistance. Morton seized Freebury round the neck with both arms and both lads went under, but ultimately Freebury was able to bring his drowning companion to the surface and support him until they were towed ashore with an oar. Morton was then in a state of collapse, but Freebury brought him round and afterwards carried him on his back the greater part of the way home, a distance of nearly five miles.

Boys Capture Housebreaker

A charge of housebreaking at Hull brought to light the story of how four Hull boys succeeded in capturing an intruder. A lad named Atkin said he was in the front room of the house with his sister, his brother and two other boys. They heard the dog bark, but on going into the back garden the lads could not see anybody. Immediately afterwards, the sister, who had remained in the house, shouted: "Boys, he is here!" The boys then rushed back into the house and on looking round upstairs found a man crouching by the side of a bed. They promptly seized him and dragged him downstairs. William Atkin, the father, said that when he arrived home he found the man detained in the house by the boys. Shortly afterwards the police arrived and the man was given into custody.

Plucky York Boy

A 14-year-old York boy, Ronald Dawson, of Kitchener Street, recently rescued a younger boy named Broadhead from the river Foss. Broadhead had fallen into the river at a point where it is at its widest and is some 9 ft. deep in the middle, and he was in great danger of drowning. Dawson rushed to the rescue, jumped into the river and after a struggle succeeded in bringing Broadhead to the bank. This brave action, we believe, has been brought to the notice of the Royal Humane Society.

Guild Member's Bravery



We have pleasure in reproducing this photograph of Gordon Bunce, aged 12, a Meccano boy and member of Exeter Meccano Club.

Earlier in the year, at a time when the River Exe was in flood, he plunged in and succeeded in rescuing a seven-year-old boy who was in imminent danger of drowning. This brave act has since been suitably recognised in Bunce's native city, and we add our congratulations on behalf of all Meccano boys.

Bunce is a great favourite among his fellow club members and his happy disposition has earned for him the nickname of "Sunny Jim."

Rescued from the Thames

Alec Batten, aged 12, a pupil at Latymer Upper School, Hammersmith, recently jumped into the Thames and rescued an elderly woman from drowning. Batten was walking with a friend along the bank near Chiswick when he suddenly caught sight of a woman struggling in the water. He immediately jumped in, fully clothed, and brought her to the bank. Meanwhile his friend had gone for a policeman, who quickly arrived on the scene and successfully applied artificial respiration.

Sister Saved from Dog

Francis Kevin Boyle, aged 13, of Sutton Place, Hackney, London, N.E., was recently presented with the bronze life-saving medal of the Order of St. John of Jerusalem for his bravery in saving his two-year-old sister Kathleen from an Airedale terrier that had attacked her. Kathleen was knocked down by the dog in the street and Francis pushed the dog off and held Kathleen high in his arms to shield her from danger. The dog then attacked and bit him repeatedly, but he continued to hold his sister in safety until help arrived.

Van Boy's Presence of Mind

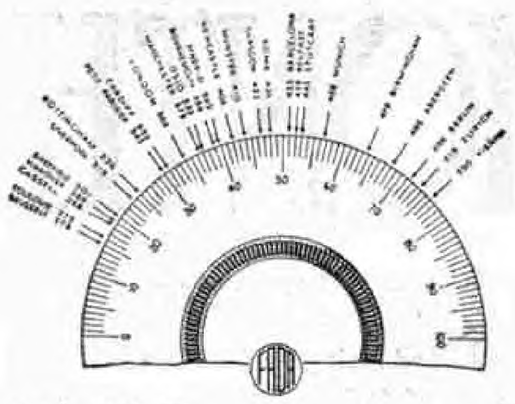
A motor van belonging to a firm of confectioners recently crashed into a refuge in Southampton Row, London. The driver was thrown clear of the vehicle and was uninjured, but the van boy, William Bullock, of Millar Avenue, Shacklewell, aged 16, was thrown through the wind screen and caught with his head over the front of the van. With great presence of mind he leaned forward, lifted the bonnet and shut off the engine which was still running. He was taken to hospital where he was detained suffering from cuts and severe shock.

14-Year Old Boy's Bravery

A courageous act has been performed by a 14-year old Shettleston boy, Colin Mogford, of 613, Shettleston Road. While on a picnic from Shettleston to Erskine Ferry several children were watching the ferryboat plying backward and forward. Suddenly a young girl overbalanced and fell into the river, and was being carried out into mid-stream when Mogford dived in to her aid. After a sharp struggle he succeeded in bringing her to land. She was then unconscious but recovered after artificial respiration. Mogford's gallant action is to be brought to the notice of the Royal Humane Society.

A Narrow Escape

Horace Sellings, aged eight, of Brook Cottages, Swanbridge, near Barry, was walking home from school with his sister Augusta, aged five. On reaching a pond the little girl said she was going to gather water-cress, and ran off. Her brother was walking on slowly when he heard a scream. Turning round he saw his sister shoulder high in the water and sinking in the soft mud at the bottom. He jumped into the pond to her assistance and found that his feet were being gripped by the clinging mud, but he struggled on and reached his sister, but not before she was completely under water. By a great effort he brought her to the bank, where she soon recovered.



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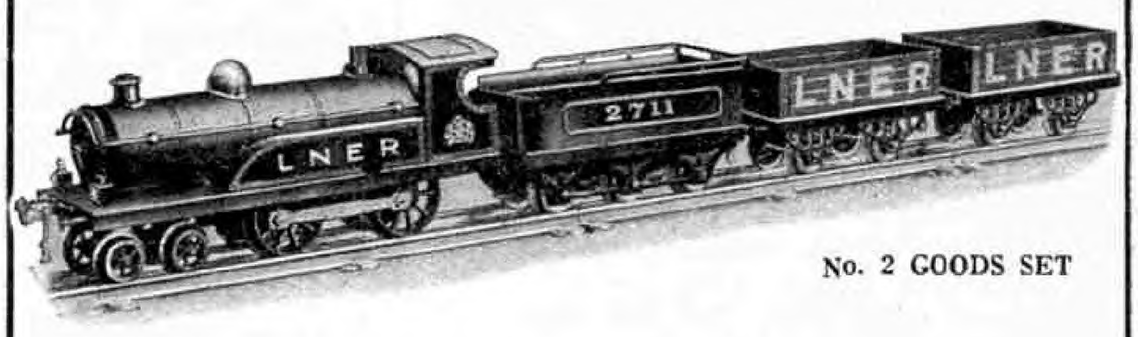
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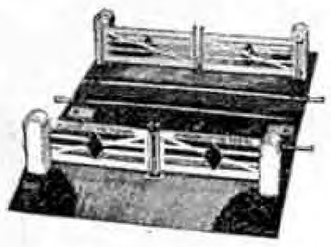
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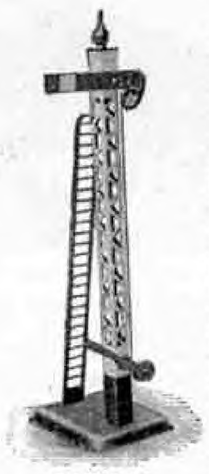
LEVEL CROSSING

Beautifully designed in colour. Measures 11½ × 7½ in. with Gauge 0 rails in position. Price **6/6**



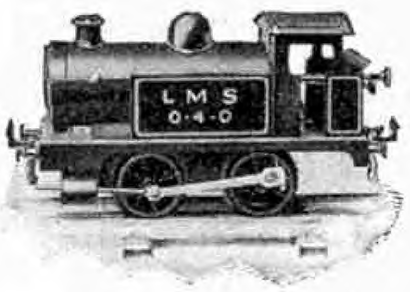
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October Puzzle Competition

ATTEMPTS to win the special prize of £1/1/– I offered last month for the best puzzle connected with railways have been submitted in large numbers. They have not yet been sorted out finally, but among them I notice many novel ones and a considerable number of old acquaintances. I hope to publish a selection of these puzzles and give my sharp-witted readers an opportunity of solving them.

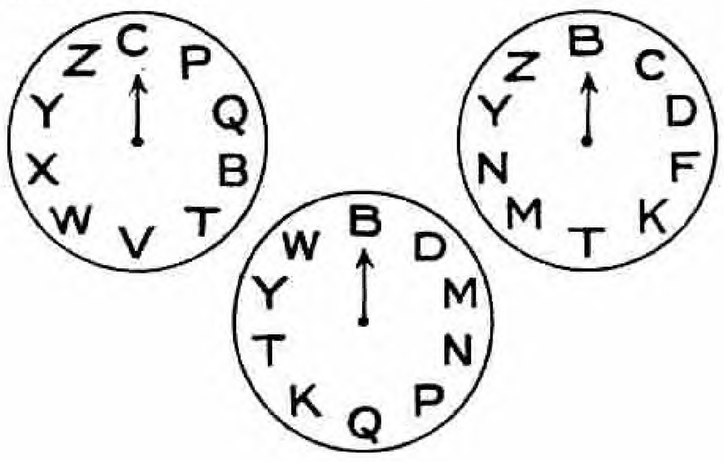
Puzzles reach their greatest popularity in the long nights of the winter months, and during this period our *"Puzzles Page"* comes in for a large share of attention. I am always on the lookout for fresh ideas for this page, and this month I am offering a special prize of £1/1/– for the best suggestion for the improvement of the page. I advise readers who intend to try for this prize to look through the *"Puzzles Page"* in their back numbers of the *"M.M."* in order to obtain a good idea of the ground that has already been covered, and then to write down any suggestion that occurs to them. Competitors may send in as many suggestions as they wish, but each one will be regarded as an independent entry, and therefore they should be written on separate sheets of paper. The competitor's name and address should be clearly written on the back of each sheet. Entries must reach this office on or before 31st October (Overseas, 28th February).

In addition to this competition 2/6 will be paid for each puzzle published and 5/– for the best one of the month.

As usual I am offering three prizes of Meccano goods to the value of £1/1/–, 10/6 and 5/– respectively, for the three best sets of solutions of 8 of the puzzles on this page. The closing date is 31st October and there is no Overseas section.

Puzzle No. 125.

A certain jeweller had a safe installed in which he placed his precious stones. In order to make the safe burglar-proof he had a combination lock fitted, which was operated by the pointers upon three dials. These three dials were lettered as shown in the diagram below and in order to open the lock each pointer had to be moved to point to a certain letter. These three letters formed a word in the English language. What was the word ?



Puzzle No. 126.

An old tombstone was found in the churchyard of an East Anglian village. This stone bore the following inscription carved in old-fashioned letters. What does the inscription mean ?

BENE
AT. HTH. IS. ST
ONERE.POS. ET
H. CLAUD. COS. TERT
R. I. P
ES. ELLE. RO
F. IMP
IN.G.TONAS.DO
TH.HISCO
N.SORTJ
A. N. E

* * * *

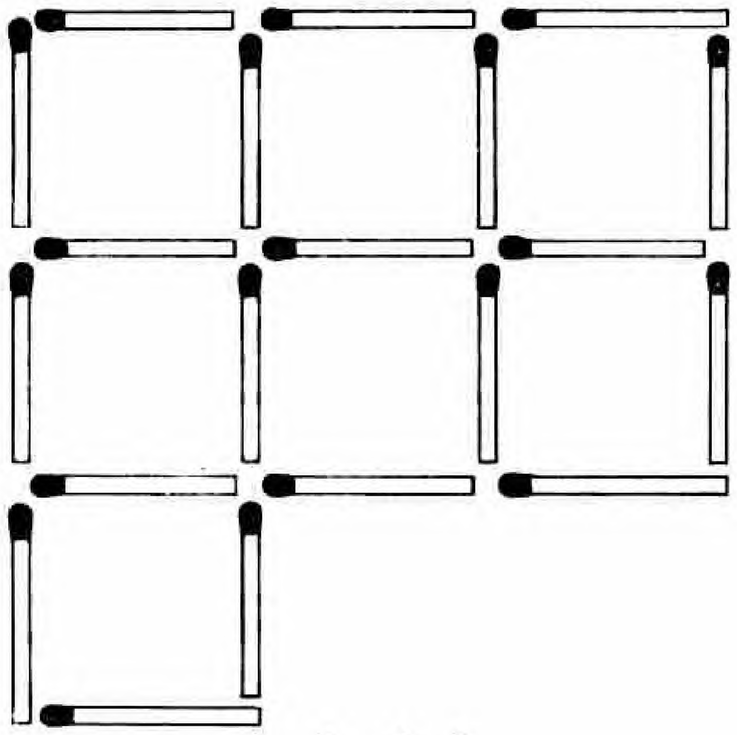
Puzzle No. 127.

What English word of three syllables consists of only four letters, three of which are vowels ?

* * * *

Puzzle No. 128.

Arrange 20 matches to form seven adjoining squares as in the following figure. The problem is to move three matches so as to make only five adjoining squares.



* * * *

Puzzle No. 129.

Behead a beast and it becomes a larger beast. Behead this large beast and instead of one it becomes ten.

* * * *

Puzzle No. 130.

What sentence is represented by the following arrangement of words :—

Stand	You	Take	To	Takings
I	heard	And	Throw	Our

* * * *

Puzzle No. 131.

A father is eleven times as old as his son. Six years hence he will be five times as old. What is the father's age ?

* * * *

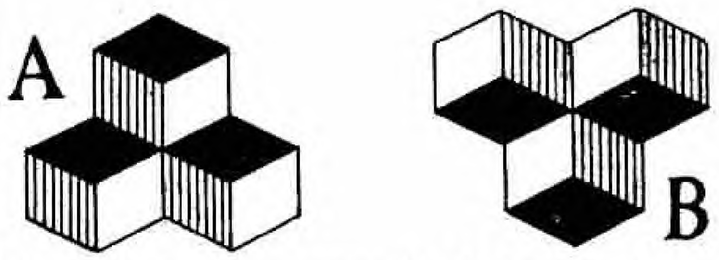
Puzzle No. 132.

Buried in each of the following lines is the name of a coin of some country. What are these coins ?

1. Hope, so they say, never dies.
2. Tame decoys entice wild ducks.
3. The hares ran narrow risk of capture.
4. Where all are brilliant none predominates.
5. The Incas had stores of hidden wealth.
6. A company, or guild, eradicates distress.
7. The peaks of Peru, peer of three different regions.
8. The fallen idol largely blocked the doorway.
9. The hunted antelope set a gallant pace
10. Great countries are those of prolific enterprise.
11. Keep arable land free from weeds.

Answers to Last Month's Puzzles

No. 117. This is an optical illusion. If the cubes are regarded as having black tops, as at A below, then there are six of them. If on the other hand they are regarded as at B, there are seven. The formation and number of the cubes appear to change as we look at the figure.



No. 118. There were originally 324 Crusaders forming a square 18 by 18. When the stranger joined them making a total of 325 they formed themselves into thirteen squares 5 by 5.

* * * *

No. 119. The sentence is as follows : "Old port from Oporto good for orthodox Oxford Dons."

* * * *

No. 120. There were 991 cats and each killed 1,009 mice.

* * * *

No. 121. A River.

* * * *

No. 122. 14 Boys.

* * * *

No. 123. Two cups of tea and two eggs would cost 1/–.

* * * *

No. 124. No quail will quail before the wind,
The bough will bow before it.
We cannot rein the rain or find
that earthly powers reign o'er it.

Puzzle No. 133.

One suit of a pack of cards is arranged so that the first card dealt out is the ace, then the next card is put at the bottom and the next dealt out is a two, the next is put at the bottom and the next dealt out is the three, and so on until all are dealt out in order from ace to king. In what order must the thirteen cards be arranged ?

* * * *

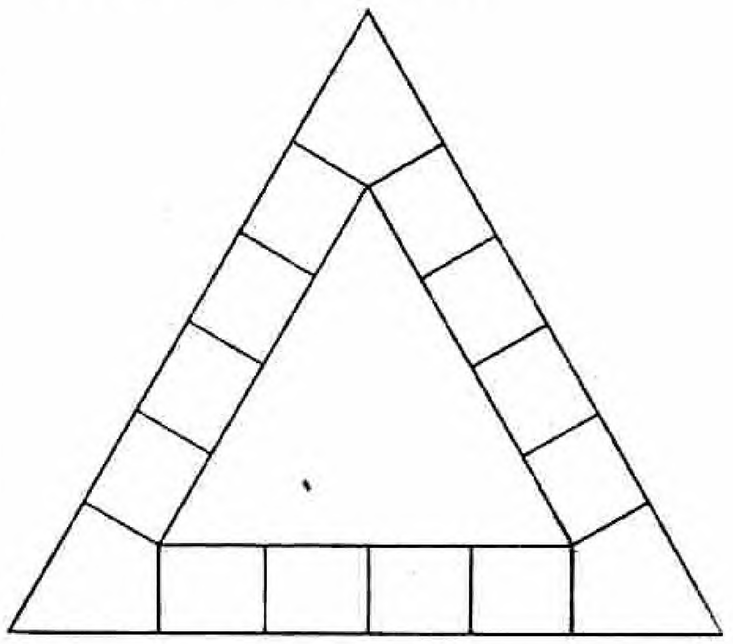
Puzzle No. 134.

A store contained a certain number of eggs. If these were counted in twos, threes, fours, fives or sixes there was always one egg over, but if they were counted in sevens they worked out evenly. How many eggs were there ?

* * * *

Puzzle No. 135.

The triangular figure shown below contains fifteen compartments. What numbers must be placed in each compartment so that the total of all the numbers on each side of the triangle is 84 ?





The Secretary's Notes

The commencement of the First Winter Session of 1925 finds the Meccano Guild in a stronger position than ever before.

The New Session

Not only has the membership grown steadily during the year, but also there has been a clearly perceptible increase in the enthusiasm and influence of the great majority of clubs. The older affiliated clubs are looking forward with confidence to the renewal of winter activities and the recently affiliated clubs, and more especially the newly formed clubs that are not yet affiliated, are approaching the session with the determination to achieve success and ultimately to take their place alongside the veteran clubs of the Guild.

I wish to draw the attention of secretaries of affiliated clubs to the fact that club membership cards are now available.

Membership Cards

These cards are provided free of charge for all affiliated clubs, one for each member. The inside of these cards is ruled to permit of the insertion of the club programme for four sessions, and each member is expected to fill up his card as soon as the programme has been arranged. The Guild rules are printed on the back of the cards. Secretaries of affiliated clubs should apply immediately for these cards, stating the number of members on their roll.

I am glad to be able to report a great improvement in regard to the sending in of club reports. Frequently these reports are disappointing, however, as they are too brief to give any real idea of the progress and prospects of the club. Every club has its own individuality and it is just that individuality that is so often missing from secretaries' reports. The "Club Notes" page that appears month by month in the "*M.M.*" is compiled from reports sent in by secretaries and its interest is dependent upon these reports. One or two striking instances of the value of "Club Notes" have recently come to my knowledge. In one note reference was made to the good work of a Lancashire member who had designed a Meccano poster for his club. This reference attracted the attention of one of the largest and most influential overseas clubs and this club sent to Lancashire for that particular member to send samples of his work. In another case a novel method of spending an informal evening in the club

Value of "Club Notes"

room, tried by an Australian club, caught the eye of a secretary in this country and the idea was tried, with slight modifications, and proved very successful. Just as the "Correspondence Club" forms a means of communication between Guild members all over the world, so the "Club Notes" page may be made the means of striking up interesting and useful associations between one club and another. In this connection I should like to see a more frequent exchange of letters between the secretaries of the various clubs all over the world, for I am sure that this would result in awakening greater interest among members and at the same time would tend to widen the outlook of the clubs concerned.

I am afraid there is a tendency among the clubs that have not yet obtained affiliation to think that their work is not of sufficient interest to be included in "Club Notes." This is a great mistake. I am keenly interested in the unaffiliated clubs, and nothing gives me greater pleasure than to record their progress regularly in "Club Notes" and to watch them grow from small beginnings to an established position among the affiliated clubs. Now that I have drawn attention to this matter I hope that the secretaries of unaffiliated clubs will send in reports regularly month by month.

Clubs not yet Affiliated

During the coming winter sessions there are two features that I should like to see more generally adopted by clubs. The first of these is that of lectures or talks by local gentlemen. Many clubs do not appear to make any effort in this direction and I can assure them that they lose a great deal by their neglect. In every locality there are gentlemen whose occupations are of great interest to boys and as a rule, if they are approached in the right spirit, they are willing to spend an hour or so one evening in giving an informal talk on the more interesting features of their occupations. The seeking out and approaching of these gentlemen should be regarded by club Leaders and Secretaries as an essential part of their work. There is no great difficulty about the matter. All that is necessary is to convince the person concerned that the members of the club really want to know something about the particular occupation in which he is engaged, and that they will be keenly interested in everything he tells them about it. As a rule there are also local gentlemen who have a wide knowledge and experience of some particular hobby, and they are generally so enthusiastic about their hobby that there is little difficulty in persuading them to talk about it.

Talks by Local Gentlemen

The second feature to which I wish to call attention is that of Visiting Nights. It is my experience that large numbers of people have practically no idea of the working of Meccano clubs, and this ignorance is naturally accompanied by indifference. The best remedy for this state of affairs is to let people see the club at work. I should like every club to arrange one or two nights during each of the winter sessions as Visiting Nights. These nights should be kept prominently before the members and arrangements should be made to ensure a full attendance and a good display of the club's work. Invitations should be sent out well in advance to the parents and friends of members and to any other people who are likely to be interested. No trouble should be spared in making these Visiting Nights a success because their value cannot be over-estimated. When people have once visited a Meccano club and seen for themselves the work that is being done, their indifference disappears and in many cases they become as enthusiastic as the boys themselves.

Visiting Nights

St. James' (Exeter) M.C. Football Team



Our photograph shows a group of footballers of the St. James' Choristers' Meccano Club, Exeter. Under the enthusiastic and skilful guidance of the Leader, Mr. M. C. Hodder, who is seen in the centre of the photograph, the St. James' club has grown steadily to its present membership of 80.



CLUB NOTES

Handsworth M.C.—Has been dormant during recent months but preparations have been made for the new session and it is hoped to obtain a considerable increase in membership. It has been necessary to change the club's headquarters. Club roll: 45. *Secretary*: Norman J. Robertson, 30, Hinstock Road, Handsworth Wood, Birmingham.

Rosyth M.C.—Has held its annual excursion which was enjoyed greatly. On another occasion an out-door evening was spent in "Trailing and Tracking." A "Special Effort" Week is shortly to be held and it is hoped to recruit many fresh members. *Secretary*: E. T. Hunter, 79, Admiralty Road, Rosyth, Scotland.

St. Mary Bourne M.C.—The annual camp in August was as successful as ever. An interesting event was a Cycle Excursion to Newbury. Joint meetings are being arranged with the neighbouring West Tytherley Meccano Club. Club roll: 22. *Secretary*: D. L. White, "Rosedale," Stoke, near Andover, Hants.

Accrington M.C.—Cricket matches have been a popular feature during the summer, and now the football team is being re-organised. R. Rush, a member who has done good artistic work for the club, has been invited by a prominent Colonial club to submit designs for a club poster. Club roll: 27. Average attendance: 15. *Secretary*: V. Waterhouse, 45, Ramsbottom Street, Accrington, Lancs.

Westcliff and District M.C.—The Sale of Work, held in conjunction with a Garden Fete, was a great success, and a good profit accrued. D. S. Cecil, the secretary, now executes his own printing, including the club magazine, "The Hound." Copies of this excellent little paper may be had post free by sending 2½d. in stamps to the secretary, who is also willing to communicate with other secretaries in regard to printing. Club roll: 34. Average attendance: 34. *Secretary*: D. S. Cecil, 22, Valkyrie Road, Westcliff-on-Sea. Girl's Section—Club roll: 9. Average attendance: 9. *Secretary*: Miss Helen A. Cecil, 22, Valkyrie Road, Westcliff-on-Sea.

Bures M.C.—Following upon the recent successful Fete many applications to join both the Guild and the club have been received. A Football Team is being organised and it is hoped to fix matches with other Meccano Clubs in the Eastern Counties. The secretary has inaugurated a Radio Section, and his own four-valve set is doing good service. Club roll: 14. *Secretary*: J. Deaves, Radio House, The Croft, Bures, Suffolk.

Christ Church (Stratford) M.C.—A joint excursion with St. Mark's M.C. took the form of an expedition to Messrs. Bryant and May's Factory. The party of twenty-five were taken through all the departments, and the various stages of match manufacture from log to box were followed with great interest. Afterwards the St. Mark's M.C. members were entertained to tea and a social evening, and a very successful day thus concluded. A party of members paid a day visit to the British Empire Exhibition, accompanied by the Leader. Club Roll: 30. *Secretary*: R. H. Bentley, 81, Abbey Lane, Stratford, London, E.15.

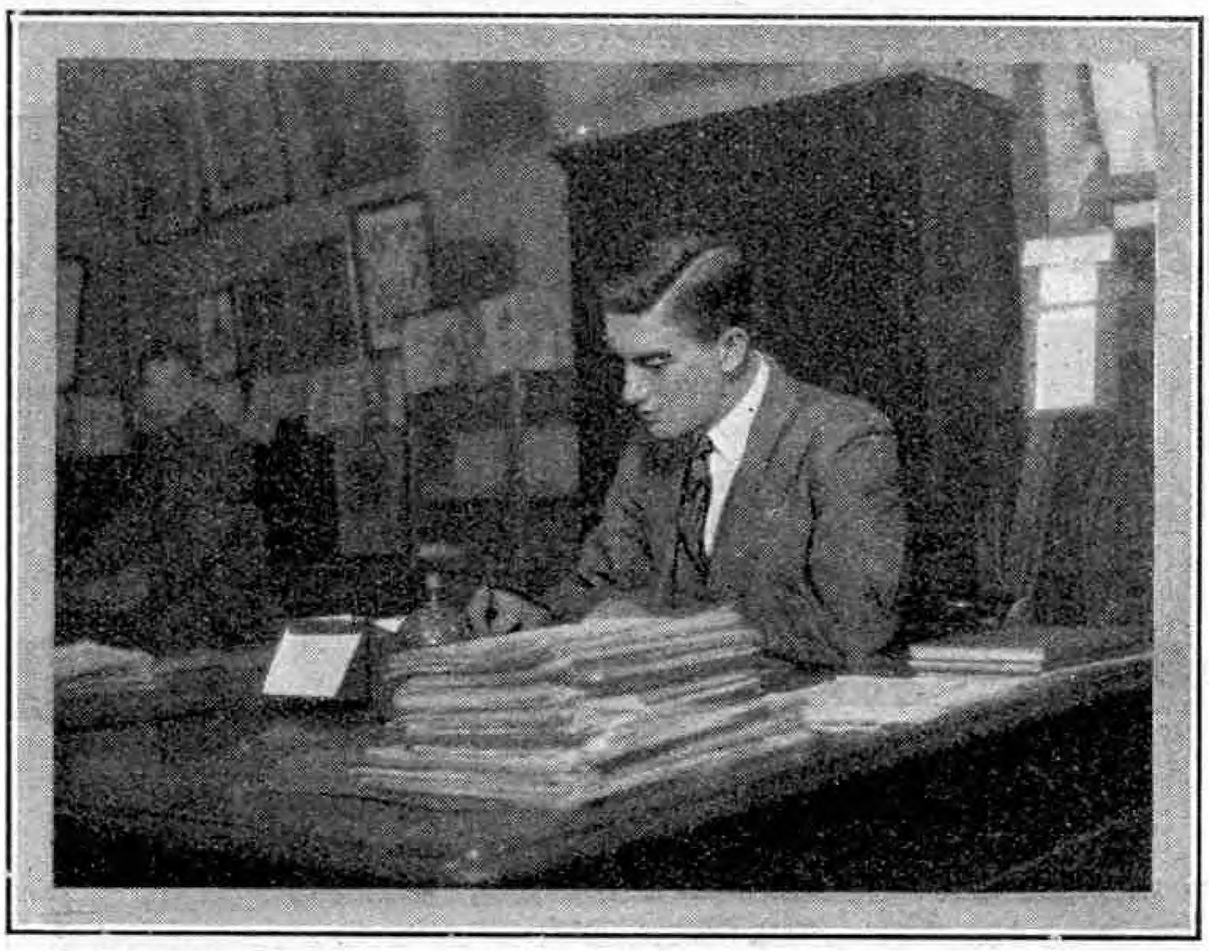
Beverley Road (Bolton) I.M.M.C.—New members have joined and the services of an Assistant-Leader in Mr. H. Settle have been obtained. A Model-building Competition resulted in the success of H. Henshaw and D. Henshaw. A club Magazine is in preparation. At the last meeting of the month interest was centred on a fine Hornby Train layout, over 40 feet of track being in use. Club roll: 14. Average attendance: 10. *Secretary*: H. Henshaw, 25, Kendal Road, Bolton.

Reading M.C.—Meetings are held weekly in the well-equipped headquarters, and alternate meeting nights are to be devoted to Model-building with a view to completing a "Meccano Fair," the roundabouts, cake-walk, etc., of which will be driven by model steam engines and illuminated by a model electric generating set. In addition to visits to the Municipal Depots and the Great Western Railway Loco sheds, excursions to examine old churches have been greatly enjoyed. *Leader*: Mr. H. G. Rogers, 135, Liverpool Road, Reading.

St. James' Choristers' M.C.—The Holiday Camp at Goodrington Sands, Paignton, was a great success, and glowing accounts of life under canvas have been sent in. Upon the return to Exeter a special meeting was held at which prizes for the Camp Sports and Competitions generally were distributed. The members took this opportunity of making a suitable presentation to the Leader, Mr. M. C. Hodder. The success of last year's Football Team and the growth of the club have made it necessary to run several teams this season. Special club merit certificates have been printed and are to be awarded to deserving members. The certificates bear a photograph of the club's model of Exeter Cathedral. Club roll: 80. *Secretary*: L. Mathews, 44, Rosebury Road, Exeter.

Meccano Club Secretaries

No. 5. Mr. C. A. E. Curle



Mr. C. A. E. Curle is secretary of the St. Mary (Newington) Meccano Club, London. For a long time this club had the honour of being the largest Meccano club in the world, and although its membership has been exceeded recently by two colonial clubs, it still remains by far the largest club in Great Britain.

The St. Mary Club was founded at the beginning of 1921 by its present Leader, Mr. G. Treves, as the St. Mary with St. Gabriel M.C. The present name was adopted in 1923, in which year a re-union of some two hundred members and ex-members took place. The club has been successful from its inauguration and has progressed steadily as a result of its enterprising policy.

The splendid organisation of the club's programmes session after session forms a splendid testimonial to Mr. Curle. In addition to his general work he is largely responsible for the publication of the club's interesting Magazine. The spirit of enthusiasm runs high among the members of the St. Mary Club, and this spirit is to a great extent a reflection of Mr. Curle's personal enthusiasm guided by sound business ability

Stockton M.C.—A working model of a Transporter Bridge was lent from Headquarters for a Visitors' Night and it attracted great attention. The weekly meeting night is now Friday. Last month's programme included a Lecture by the Leader, and a Contractors' Night and a Hornby Train Night. Club roll: 18. Average attendance: 12. *Secretary*: N. Middleton, 14, Victoria Avenue, Norton Road, Stockton-on-Tees.

Holy Trinity (Blackburn) M.C.—T. Donald has succeeded H. Jepson as Secretary. The summer season was very successful, including many Cricket Matches and a memorable Outing to Southport where the members were entertained by the local M.C. The Football Team has resumed by securing two convincing victories, and the membership is higher than ever previously. The programme for the Winter Session includes a regular Drawing Night and a Lecture Night. Club roll: 35. *Secretary*: T. Donald, 6, Camden Street, Blackburn, Lancs.

Australia

Glenelg M.C.—At the Annual General Meeting the treasurer reported a balance in hand of 12/7 and £2/0/4 at the bank. It was decided that each member should pay a fee of sixpence on joining and subscribe 2/2 per quarter. A new club room is now being used. The monthly Model Competitions are being continued. Marks are given on these special nights and go towards the award of a silver medal offered by the Leader, Mr. Patrick. A "Hat Night" proved very enjoyable. Members drew from a hat a slip of paper with a certain subject named on it, and each had to speak for three minutes on whatever subject he had drawn. Lectures have been given on Locomotives, Motors, Ships, Cranes and Bridges. Club roll: 88. *Secretary*: Keith Holmesby, 22, Partridge Street, Glenelg, South Australia.

South Africa

Observatory M.C.—The Annual Report demonstrates the wide range of activities open to an enterprising club. During the year 1924-25 there have been 35 club meetings, 11 committee meetings, three special Exhibition meetings and a general meeting, making a total of 50. The year's programme included Model-building, Model Racing, Inventions, Philately, Lectures, Wireless Tuition, Morse Signalling, Cricket and Football, a visit to the "Cape Times" Printing Works, a Picnic, and a Christmas party which was attended by 56. The club has several Floating Trophies and Special Prizes, among the donors being the Rt. Hon. General J. B. M. Hertzog, Prime Minister. The club President, Mr. G. E. Barrett, offers a special prize to the boy who attains nearest to the following ideal:—"Must give cheerful submission to superiors, have self-respect and independence of character, kindness and protection to the weak, readiness to forgive offence, desire to conciliate the differences of others, and above all fearless devotion to duty and unflinching truthfulness." *Secretary*: Mr. S. Wilson, P.O. Box 1247, Cape Town, South Africa.

India

Calcutta M.C.—Has had a very good summer session and the meetings drew record attendances. An attractive programme has been drawn up, including a Model-building Competition and a Football Tournament. The competition is open to members under 17 and a silver cup will be awarded to the winner. The Football Tournament is extended to include all the Scout Troops and school teams in Calcutta. Mr. A. Chatterjea has kindly promised to present a cup to the winning team, the trophy to be known as the Meccano Challenge Cup. A special Merit Medallion has been awarded to M. L. Mitter for his services to the club. Club roll: 40. *Secretary*: A. N. Roy Chowdhry, 35/2, Beadon Street, Calcutta, India.

Delhi M.C.—At a special meeting held in the Commercial High School a musical programme was followed by a Display of Meccano Models constructed by members. The principal event of the evening was a talk by Madame T. De Manziarly on "Hands, Heart and Mind." The good work done by the club has attracted much attention in Delhi, and several headmasters of schools are keen for similar clubs to be established for their scholars. *Secretary*: Mr. R. Raman, Scoutmaster, Children's Meccano Club, Charkhe Walan, Delhi.

New Zealand

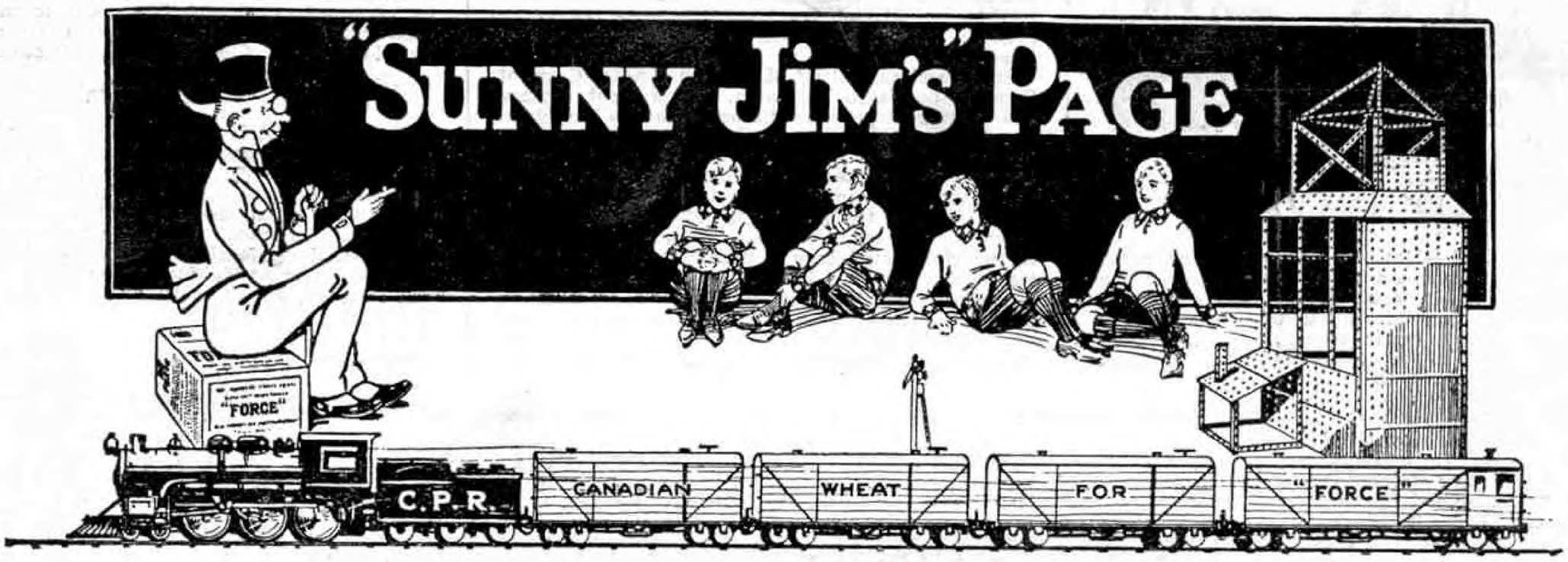
Wiseman's M.C.—A great Recruiting Campaign for the Guild is prospering. An important Model-building Contest takes place this month. It is divided into sections for boys 7-9 years old, 10-12 years, and 13 and over. Handsome prizes ranging from a watch valued at three guineas to Hornby Tank Locos and Electric Motors are to be awarded. At the meeting on 8th July the attendance was 158, including several parents. The recent visit to Auckland of the American Pacific Fleet, comprising 54 vessels, brought many boys from up-country and the opportunity was taken of bringing the Guild and the club to their notice. Club roll: 820. *Secretary*: Mr. W. Shearer, c/o Frank Wiseman Ltd., 170-172, Queen Street, Auckland, New Zealand.

Clubs not yet Affiliated

Balham and District M.C.—Is anxious to enrol additional members. A good programme is being arranged. The Leader, Mr. E. H. Bish, has had engineering experience and is making great efforts to get the club into full swing. *Secretary*: J. Buffery, 15, Drakefield Road, Balham, London, S.W.19.

Walsall M.C.—An excellent clubroom has been secured in the centre of the town, and the urgent need now is for a Leader. At a business meeting D. Schumacher was elected Chairman, G. Rogers secretary and J. Whiston assistant secretary. Club roll: 11. *Secretary*: G. Rogers, c/o 37, Thorpe Road, Walsall.

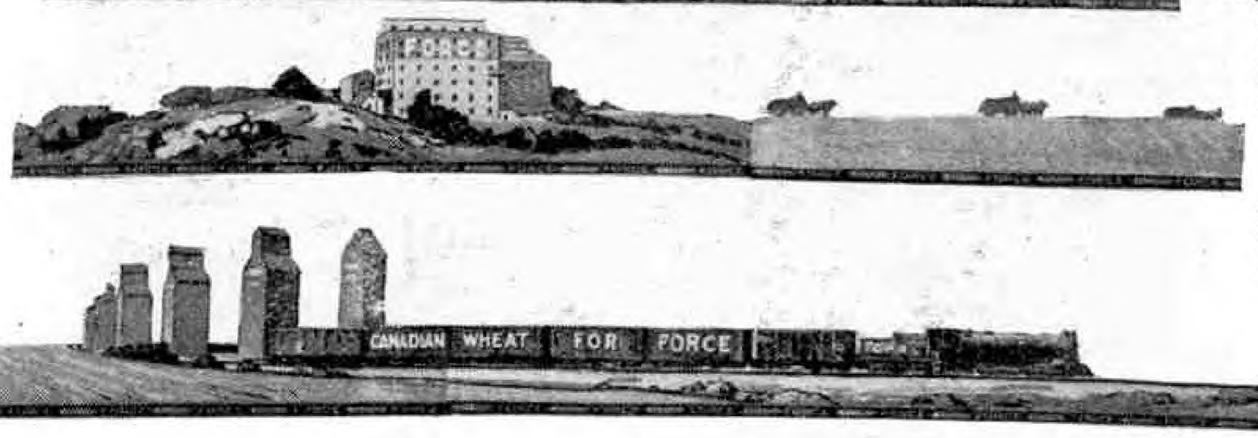
Mossley (Manchester) M.C.—Is temporarily without a headquarters, but it is hoped to get fixed up shortly. Club roll: 14. Average attendance: 10. *Secretary*: J. Yates, 8, Wood Bank Terrace, Mossley, Manchester.



HOW TO MAKE A PANORAMIC MODEL OF THE "FORCE" HARVEST IN CANADA'S WHEATLANDS

Those lucky boys who went to Wembley (were *you* one ?) saw hundreds and hundreds of models. Models of houses, models of farms and models of whole acres and acres of land. One model, the largest of them all, was a panoramic view extending right across Canada. On one side was the Pacific Coast and the Rocky Mountains, on the other was Hudson Bay, the coast of Labrador, and the mouth of the great river St. Lawrence. In between came the hundreds and hundreds of miles of land that once, when the Redskins ruled the land, was rolling prairie, but much of which is now great cultivated tracts of wheatland.











In the province of Ontario, near the great lakes, is a township that is known as Ayr. In this town are the mills that daily perform the miracle which transforms the hard grains of golden wheat into those tasty rich brown flakes of toasted malted wheat we so often see on the breakfast table. These flakes derive their name, "FORCE," from the energy producing qualities they possess. They are so wholly nourishing because they are still just as much whole wheat as the wheat grains were when they first emerged from the threshing machine. The only difference is that they are clean, steam cooked, malted and toasted, so as to be easily digestible and nice enough to make you want "FORCE" regularly every morning, like other boys do.

Now I know you are beginning to wonder when I am going to start telling you how to make the panorama, a picture of which appears at the bottom of this page. I'll start now. The first thing to do is to get the picture. I can help you here. If you send me six penny stamps towards the cost of it, and the top of a "FORCE" packet to show thatyou are a genuine eater of "FORCE," I will send you a nine colour 16 ft. long strip of harvesting pictures—the same as was used by the boys who made the "FORCE" panorama. From this big strip you can cut out all the pieces shown down the middle of this page, but before you cut them mount your strip on a nice piece of cardboard and wait for the paste to dry. When they are cut out, fix a strut to the back of each so that it will stand up by itself. Construct the panorama by arranging your pieces of scenery as shown below, or in any other way you like. More realism can be introduced if you paint a large sheet of cardboard pale blue and fix it up behind to represent the sky. The panorama shown below has the "strips" embedded in plaster which is moulded and painted to look like ploughed land and stubble. The horse and cart and the wheatsheaves in the foreground are models that can be purchased from any good toyshop.

When you have made the panorama you will still have material for more "cut-outs." Perhaps you have a model railway. Think of the many ways this scenery would come in useful ! With this panorama setting your trains will look ever so real. Additions and improvements will suggest themselves to you as you go along. There's heaps of fun for you with a "FORCE" panorama. Send for your picture strip when you get your next Saturday's money !

Address your application, enclosing one "FORCE" packet top and 6d. in stamps to:—**"Sunny Jim's" Panorama**, 197, Gt. Portland Street, London, W.1.





Fireside Fun

This Month's Short Story

Tom cat
Brick wall
Water jug
That's all.

* * * *

Reporter (interviewing self-made man): "Tell me, sir, something of your early struggles."

Self-made Man: "Well, my mother says they were terrible when she wanted to scrub my ears!"

* * * *

A certain station master on an Indian railway had been given strict instructions not to do anything out of the ordinary without authority from the superintendent. One day he sent to the superintendent the following telegram: "Tiger on platform eating guard. Please wire instructions."

The reply came: "Shoot him on the spot."

To this the station master replied: "Which spot?"

* * * *

BE(E) PREPARED!



When you see the bumble bee
Come gaily buzzing o'er the lea
You'd better let that bumble be!

* * * *

GOT IT EXACTLY!

Boss (to new man): "Take this yard stick and measure that path."

New Man (an hour later): "The path is two hundred and twice this stick, twice my feet, three and half bricks and two straws."

* * * *

Two men were having a heated argument.

"I tell you," said one, "that you are absolutely wrong."

"I am not," replied the other

"Didn't I go to school, stupid?" roared the first man.

"Yes," was the calm reply, "and you left school stupid!"

* * * *

Brown: "Where's your pal?"

Smith: "If the ice is as thick as he thinks it is, he's skating. If it is as thin as I think it is, he's swimming."

* * * *

Teacher: "Heat causes expansion and cold causes contraction. Now give me an example."

Tommy: "In summer the days are long and in winter they are short."

CHEEK!



Teacher: "Can you tell me a thing of importance that did not exist 100 years ago?"

Willie: "Me."

* * * *

"How did you lose your hair?"

"Worry."

"What did you worry about?"

"Losing my hair."

* * * *

"This is the end of my tale" said the cat as he backed into the lawn mower.

* * * *

Q. Why is a carpet like an egg?

A. Because after it is laid it is often taken up and beaten.

* * * *

NOT WHAT HE WANTED!

A story is told of an English tourist who entered a restaurant in Paris and by means of a few scraps of French was able to order dinner. Presently he thought he would like some mushrooms and not knowing the name, he asked for a sheet of paper and a pencil and sketched one. The waiter pondered for a moment, disappeared and returned ten minutes later with a handsome umbrella!

* * * *

Wife: "There's McKenzie's coo broken into the yaird again."

Sandy: "Weel, dinna stan' there doing nothing, milk her and put her oot."

* * * *

Tourist: "I suppose this rain has just come at the right time to do the crops good?"

Farmer: "Yes, sir. An hour of it will do more good in five minutes than a month of it would do in a week at any other time."

* * * *

Old Lady: "Fourpence seems a lot for an egg."

Grocer: "Yes, ma'am, but you see it's very expensive producing them. One egg is a whole day's work for a hen!"

A SLIGHT MISAPPREHENSION!



Sergeant: "Any of you men got a dirty uniform?"

Private (hoping for new tunic): "Yes, sergeant, look at me."

Sergeant: "You'll do. Report tomorrow morning at 6.30 for coal shovelling!"

* * * *

Q. Why is an empty purse always the same?

A. Because we never find any change in it.

* * * *

GOOD-BYE-E!

Professor: "My dear boy, geologists think nothing of a thousand years."

Student: "Good heavens! I lent one 10/- yesterday."

* * * *

HOW MANY KNOTS?

Mike: "How would you increase the speed of a slow ship?"

Ike: "Why, make her fast, of course!"

* * * *

Tramp: "Madam, I was not always like this."

Lady: "No, it was your other arm you had in a sling yesterday!"

* * * *

Father: "I hear your teacher called you a blockhead."

Son: "Well, no, he didn't put it as strongly as that."

Father: "What did he actually say?"

Son: "Put on your hat, here comes a woodpecker!"

* * * *

Tom: "What kind of a watch have you got?"

Sam: "A wonder watch."

Tom: "Never heard of that kind before."

Sam: "Well, it's like this. Every time I look at it I wonder what time it is!"

* * * *

Grandfather: "When I was a boy history was my favourite study."

Grandson: "I never thought there would be any history then!"

* * * *

Jim: "Look here, Tim, how do you manage to teach your mule all those tricks? I can't teach my mule anything."

Tim: "That's easily answered. You have got to know more than the mule!"

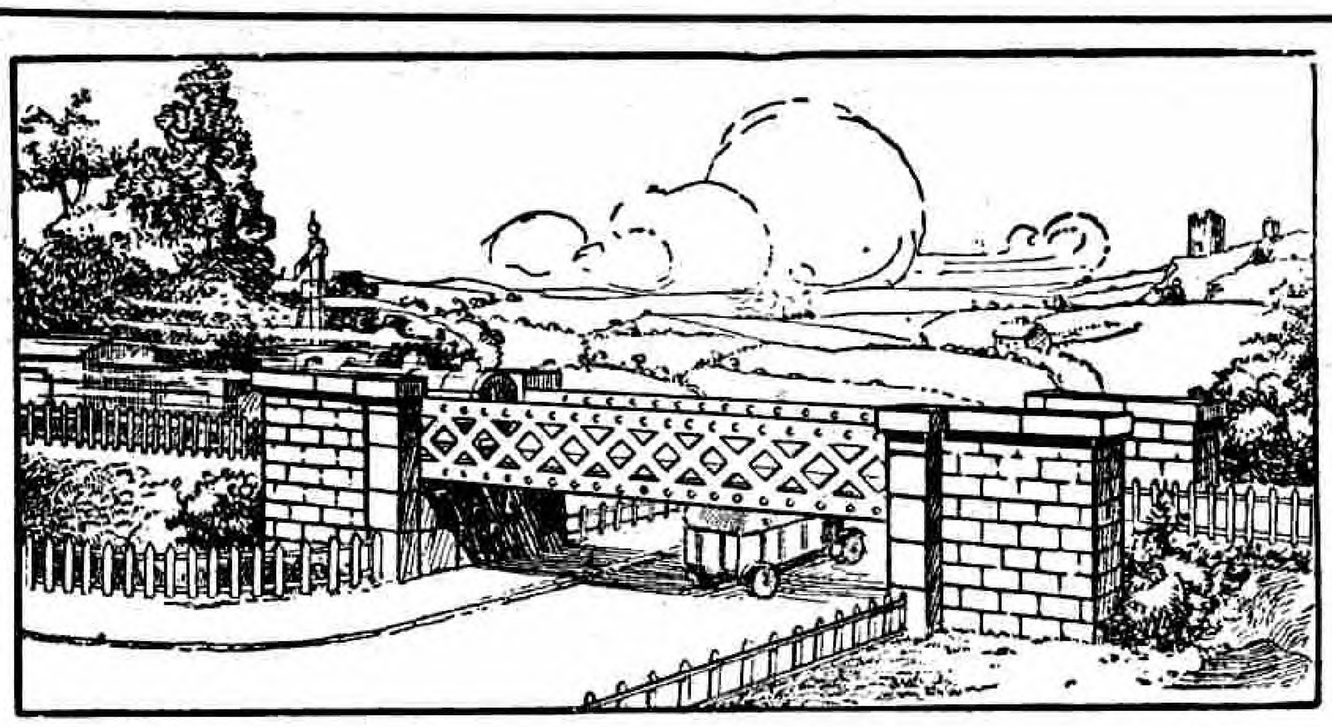
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FOR MODEL RAILWAY BUILDERS

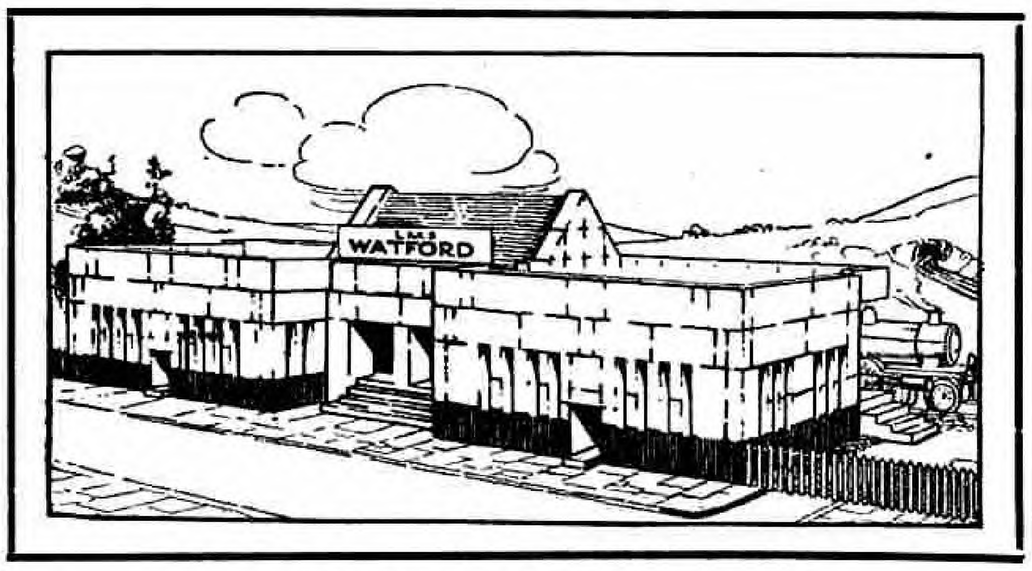
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For Particulars of our New Bridge Competition see last month's "Meccano Magazine."



SIGNAL CABIN

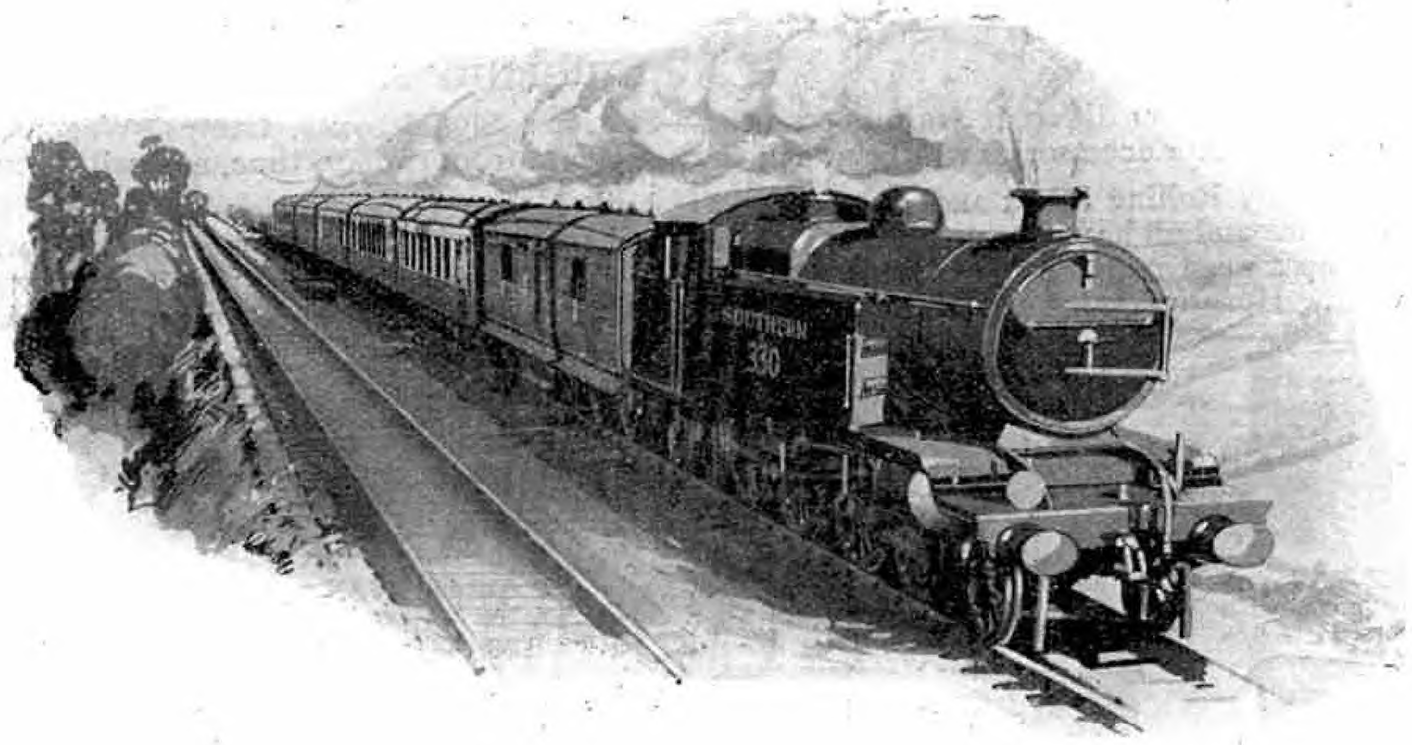
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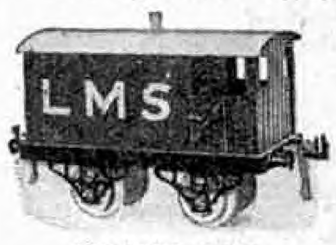
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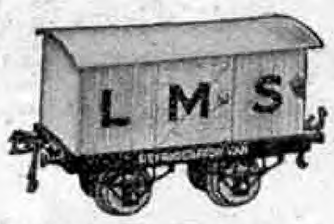
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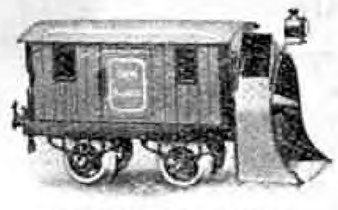
BRAKE VAN
Finished in grey, with opening doors. Price **4/–**



***REFRIGERATOR VAN**
Enamelled in white, with opening doors. Price **4/–**



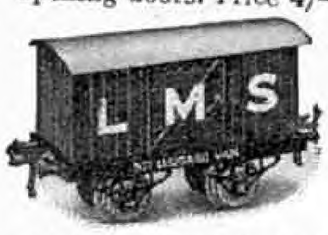
BRAKE VAN
Finished in grey, with opening doors. Price **4/–**



***SNOW PLOUGH**
With revolving plough driven from front axle. Price **5/6**



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Realistic design, fitted each side with opening doors. Price **3/6**



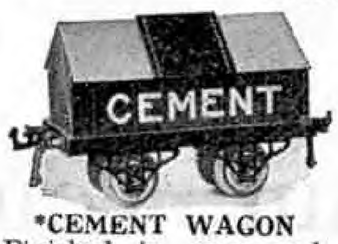
***No. 1 LUGGAGE VAN**
With opening doors. Price **4/–**



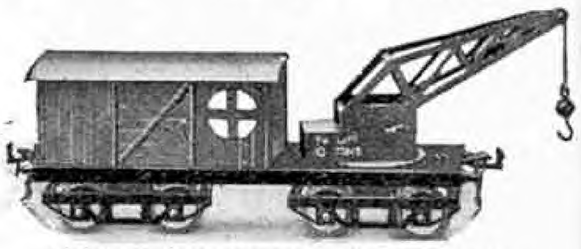
***No. 2 LUGGAGE VAN**
Finished in blue and green. Fitted with double doors. Suitable for 2-ft. radius rails only ... Price **6/6**



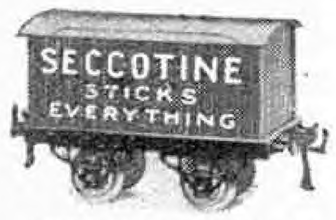
***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans. Price **4/6**



***CEMENT WAGON**
Finished in grey and black. Price **4/–**



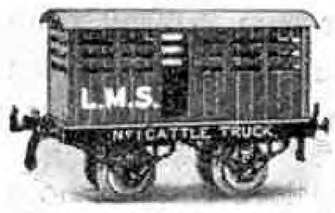
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in grey and black, with opening doors. Suitable for 2-ft. radius rails only ... ... Price **7/–**



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***No. 2 CATTLE TRUCK**
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CRAWFORD'S BISCUIT VAN
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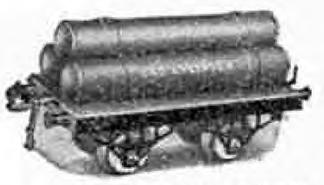
CARR'S BISCUIT VAN
Finished in dark blue, with opening doors. Price **4/–**



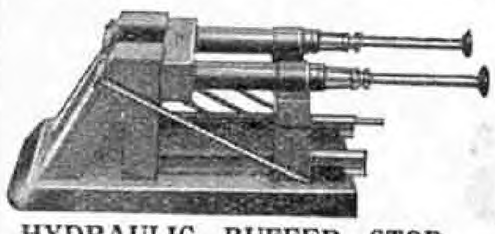
JACOB'S BISCUIT VAN
Finished in crimson lake, with opening doors. Price **4/–**



***GUNPOWDER VAN**
Finished in red, with opening doors. Price **4/–**



***GAS CYLINDER WAGON**
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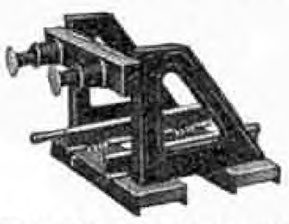
PETROL TANK WAGON "SHELL"
Finished in red. Price **3/–**



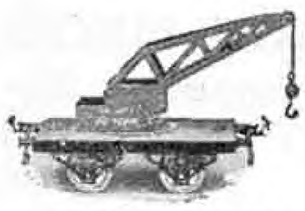
PETROL TANK WAGON "PRATTS"
Finished in green. Price **3/–**



PETROL TANK WAGON "NATIONAL BENZOLE"
Price **3/–**



SPRING BUFFER STOP
Price **1/6**



***CRANE TRUCK**
Finished in grey and black ... Price **4/6**



***HOPPER WAGON**
Mechanically unloaded. Finished in grey and black ... Price **4/–**



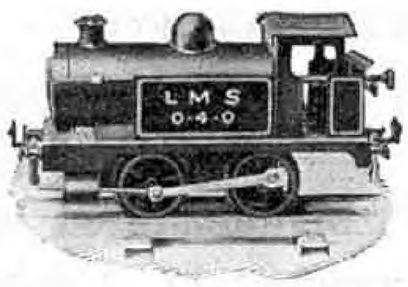
***TROLLEY WAGON**
Finished in grey and red. Suitable for 2-ft. radius rails only ... Price **6/–**



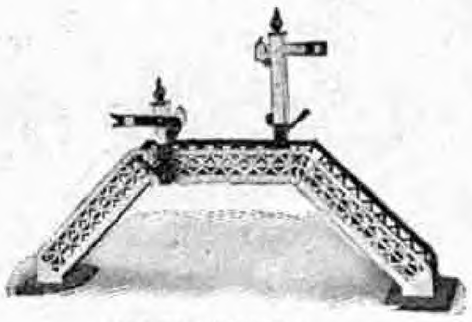
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Gauge 0, in colours to represent L.M.S. or L.N.E.R. Companies' locos. Price **12/6**



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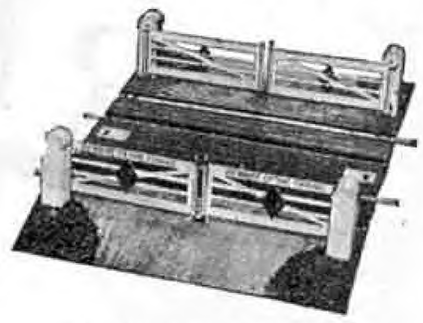
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Price **6/6**



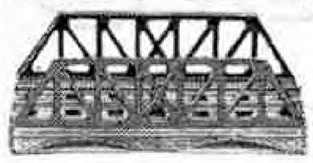
RAILWAY STATION. Excellent model, beautifully designed and finished. Dimensions: Length 2-ft. 9-in., breadth 6-in., height 7 in. Price **12/6**



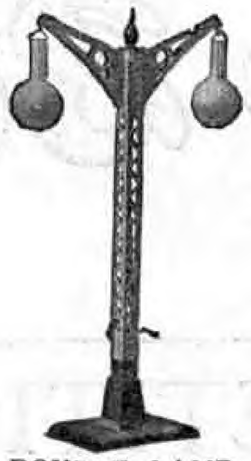
LEVEL CROSSING
Beautifully designed in colour. Measures 11½ × 7½-in. with Gauge 0 rails in position.
Price **6/6**



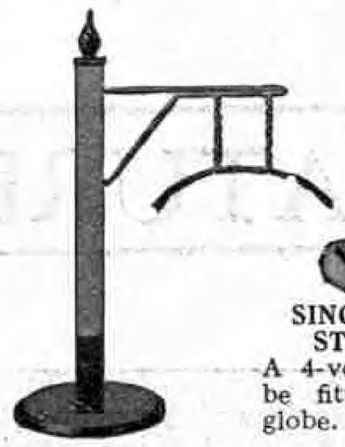
VIADUCT. Price **7/6**
ELECTRICAL VIADUCT. Price 8/-



VIADUCT (Centre Section only) Price **4/6**
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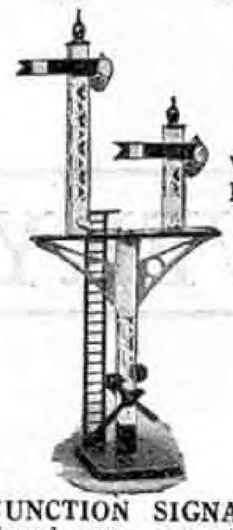
DOUBLE LAMP STANDARD
Four-volt bulbs may be fitted into the globes
Price **4/-**



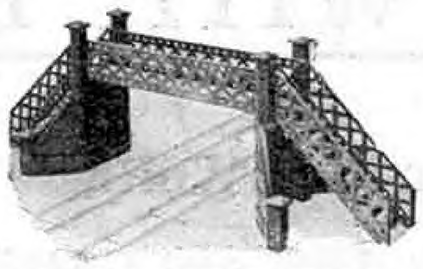


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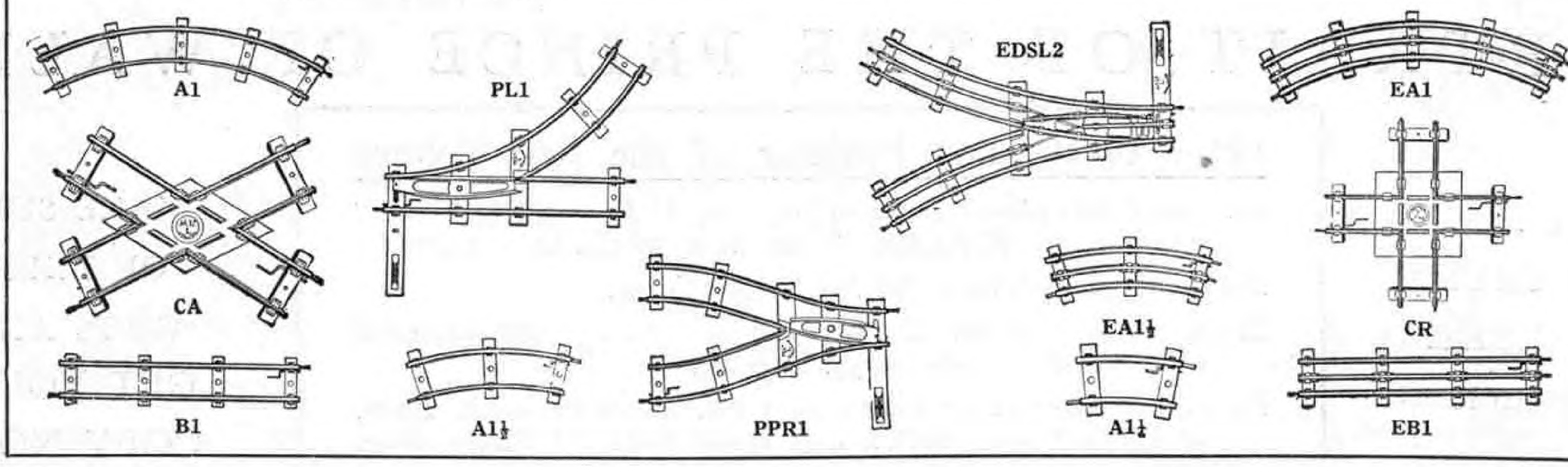
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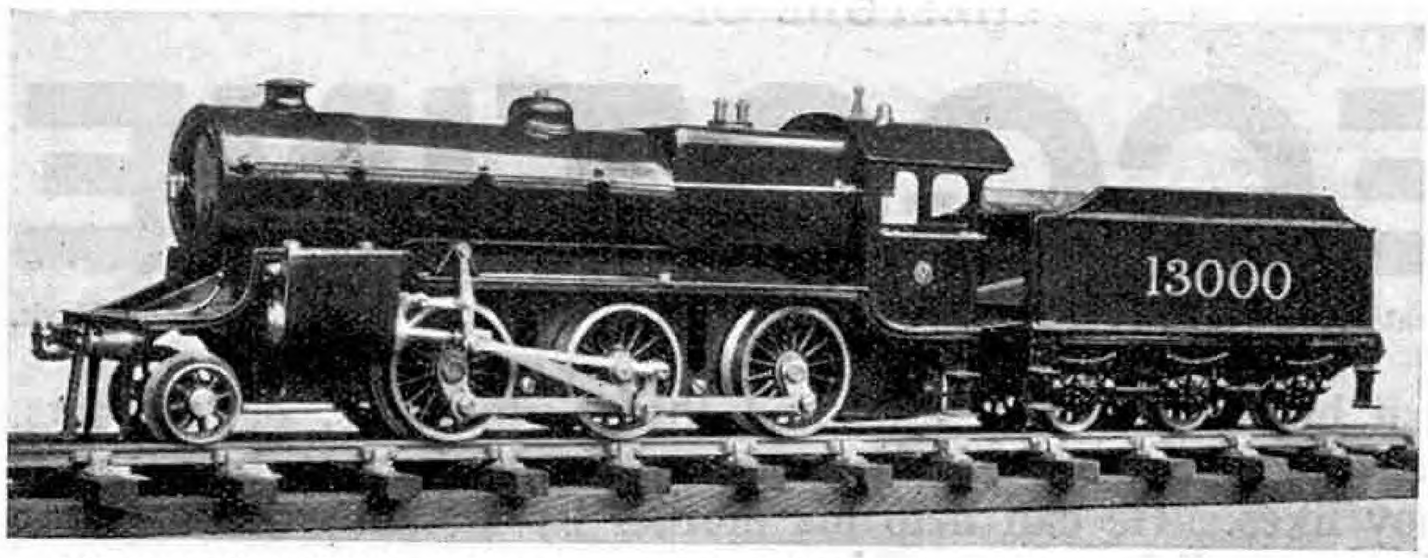
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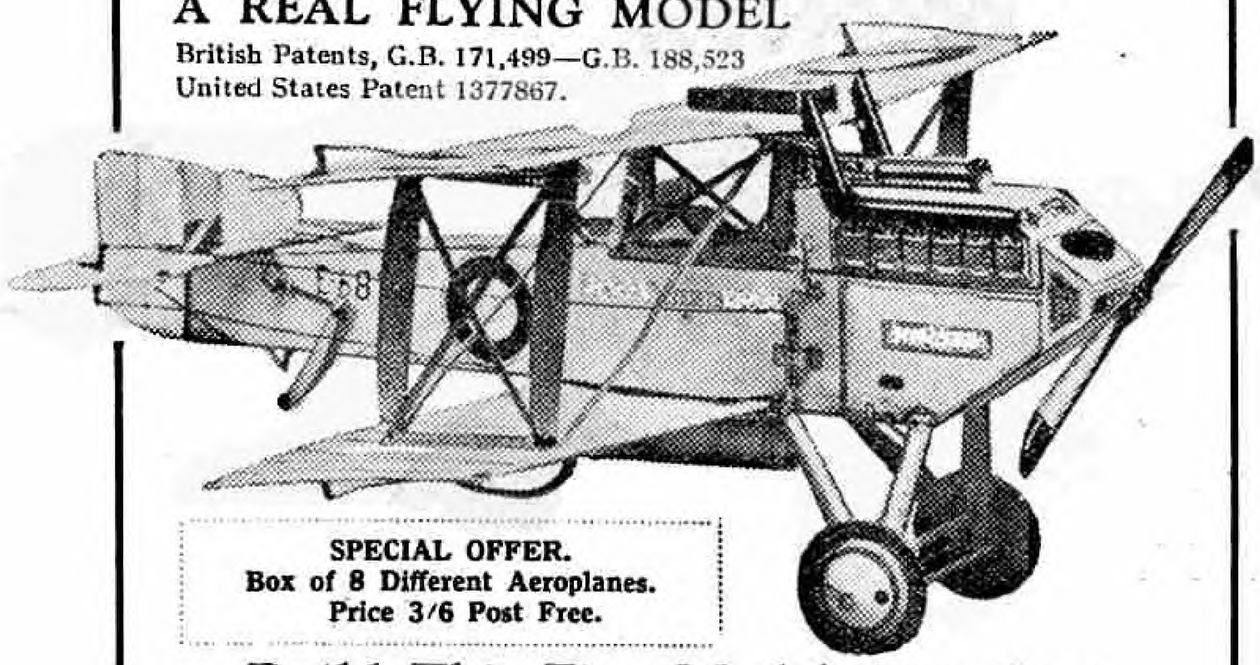
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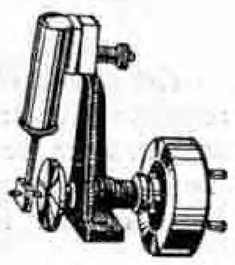
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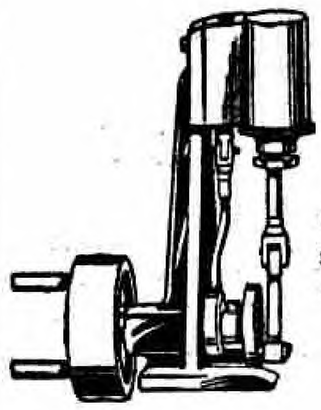
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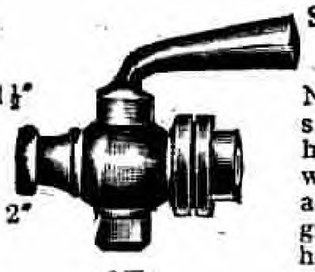
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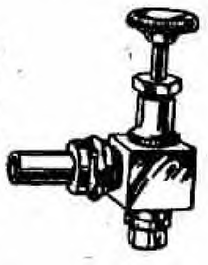
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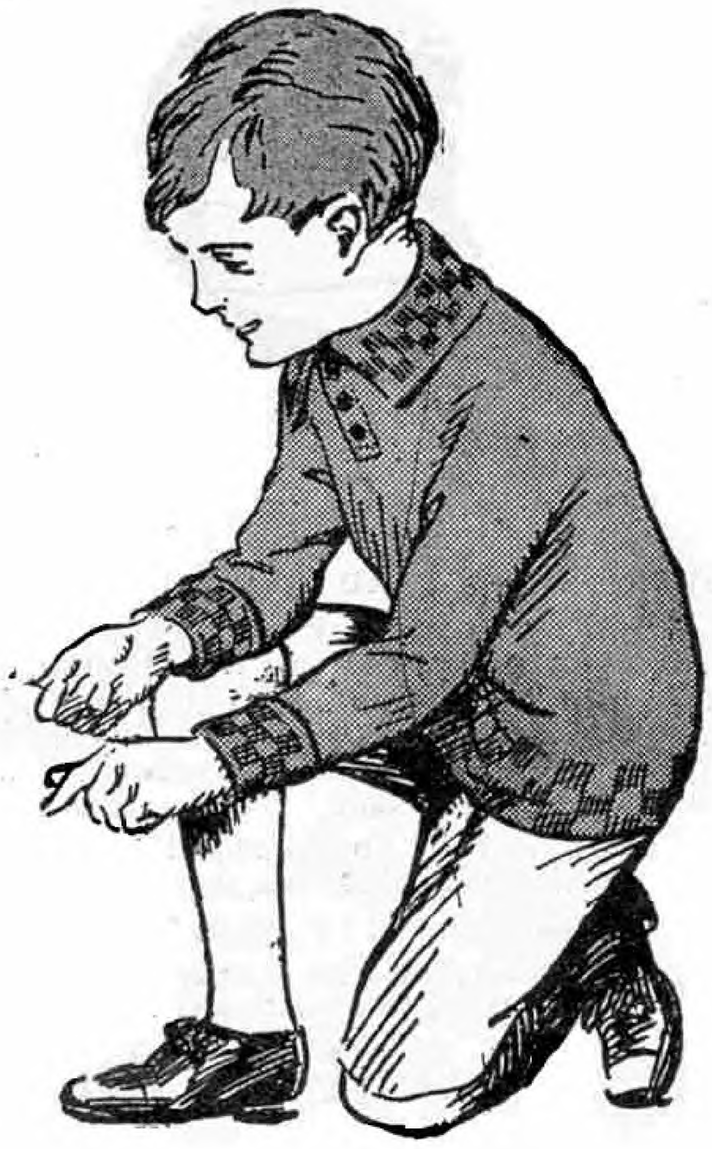
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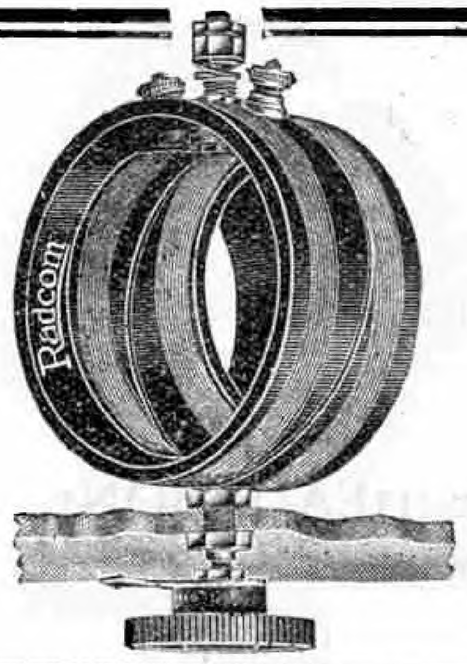
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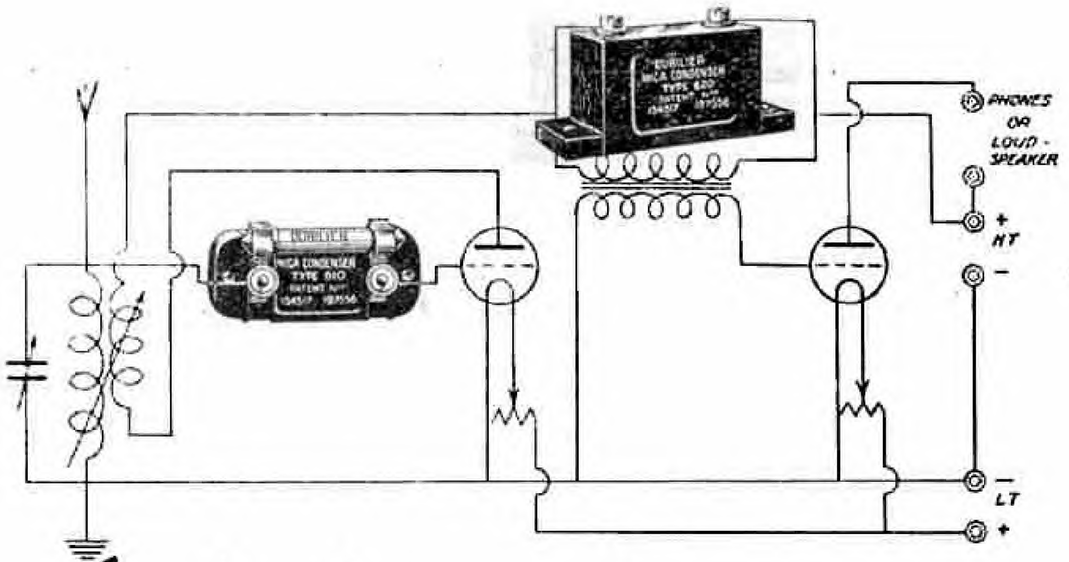
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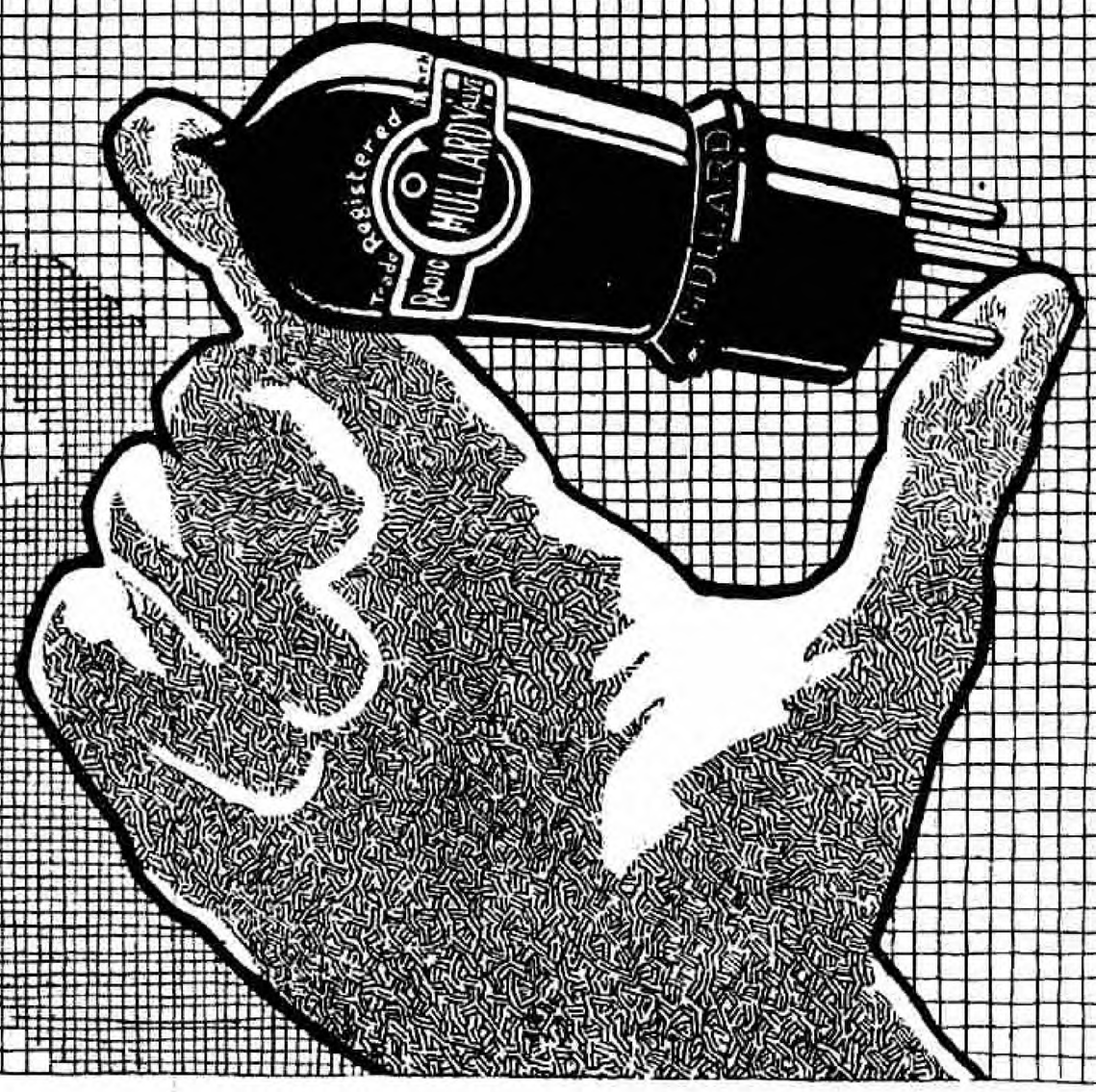
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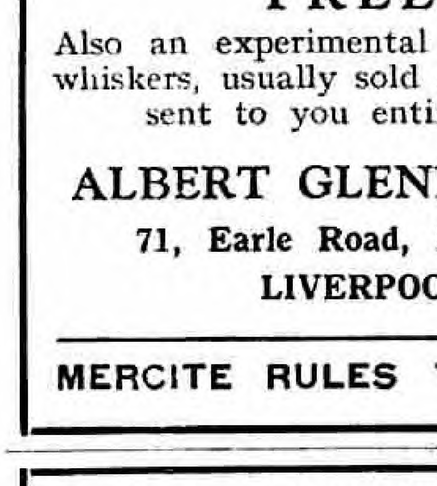
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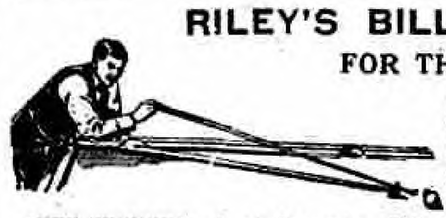


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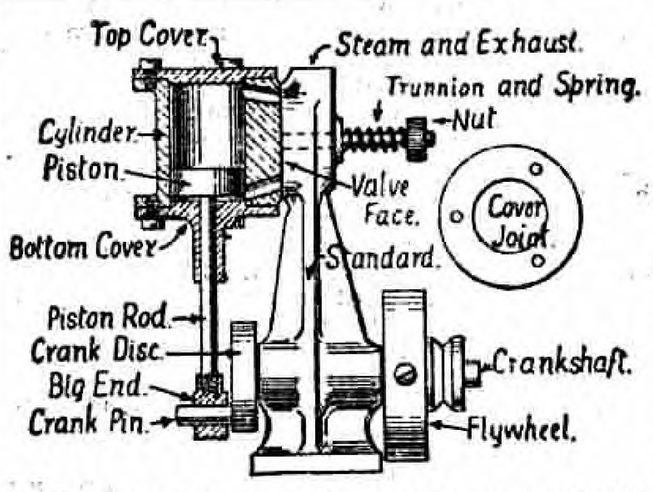
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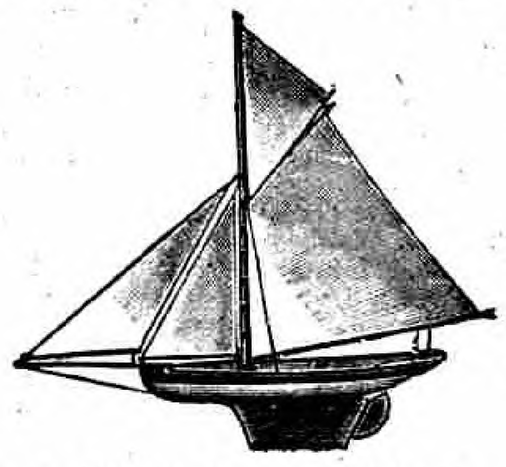
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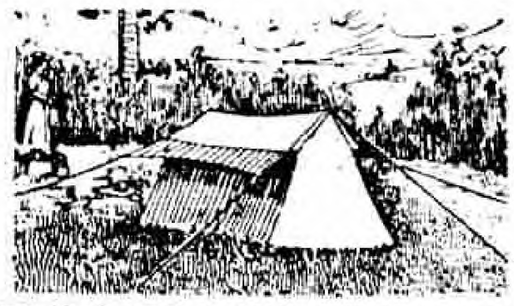
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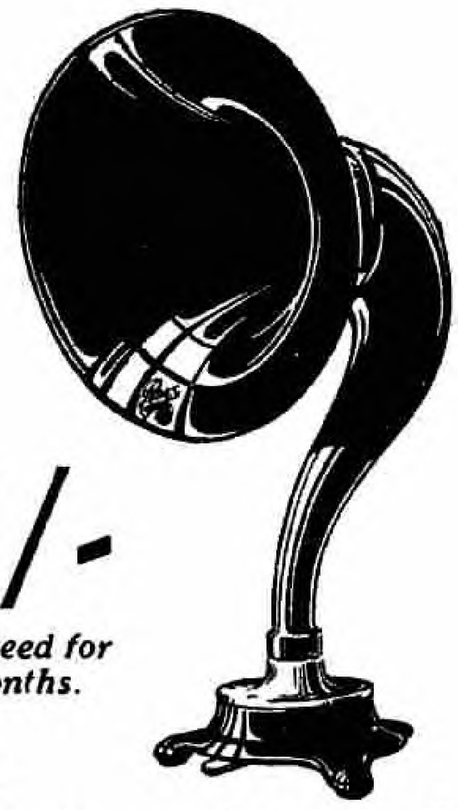
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Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms.

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This Month's Special Articles

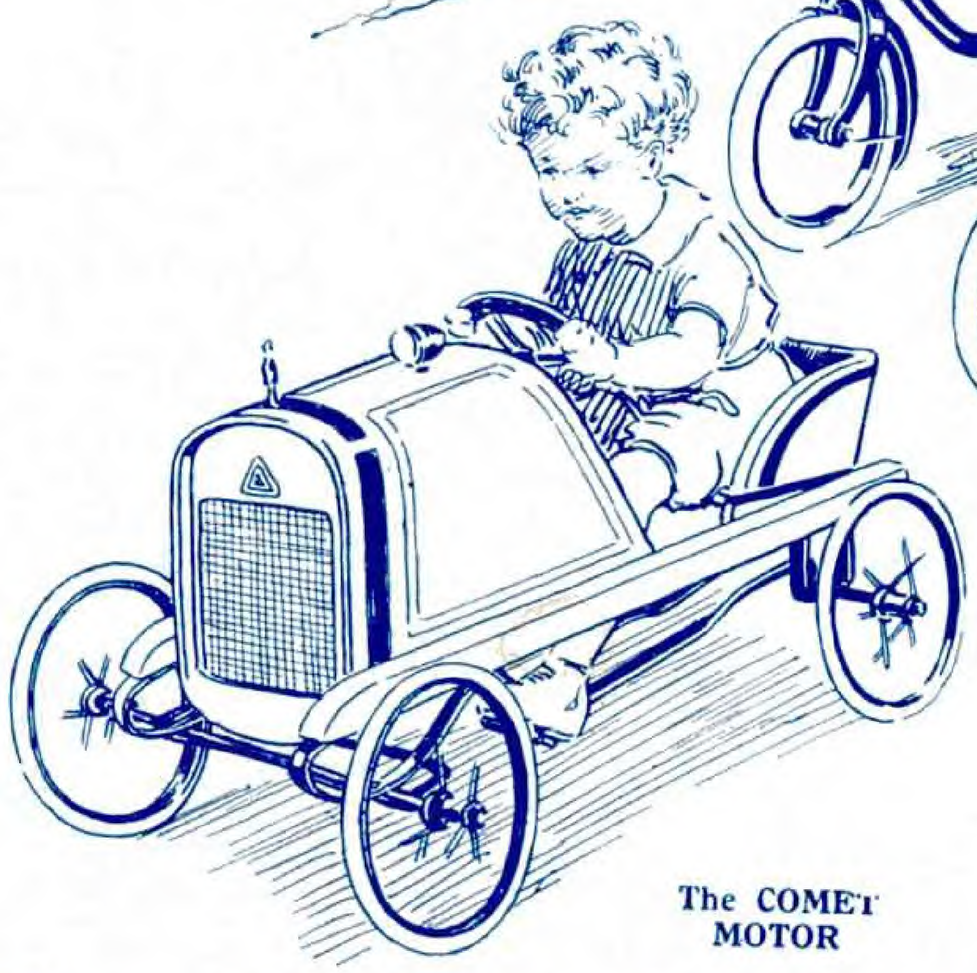
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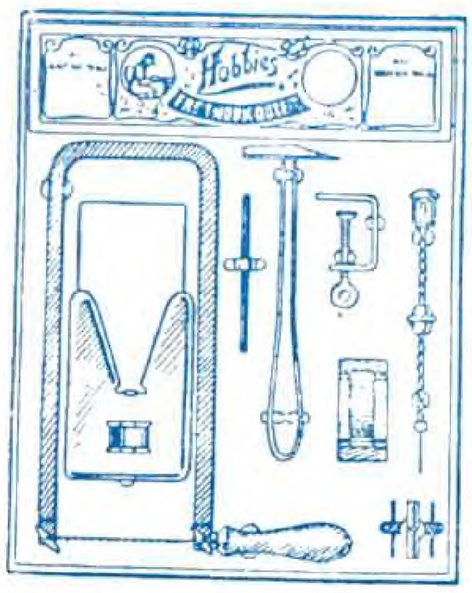
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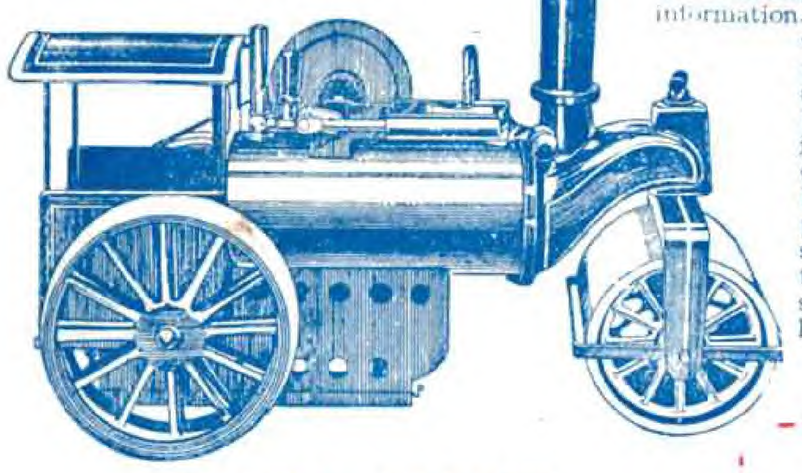
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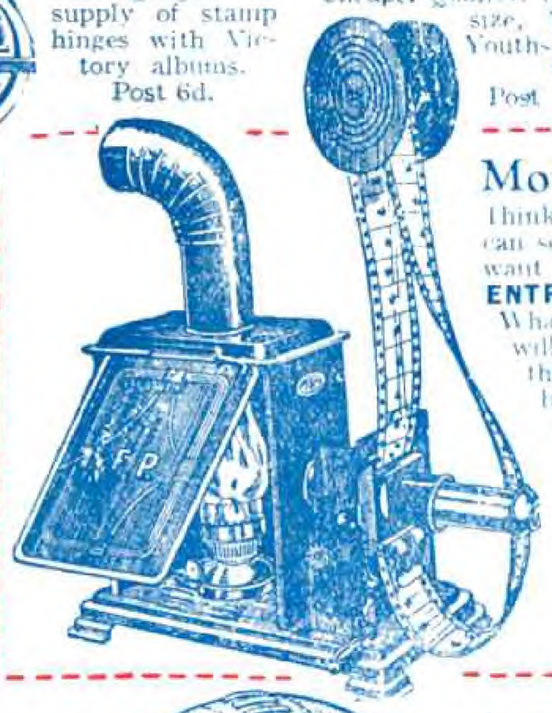


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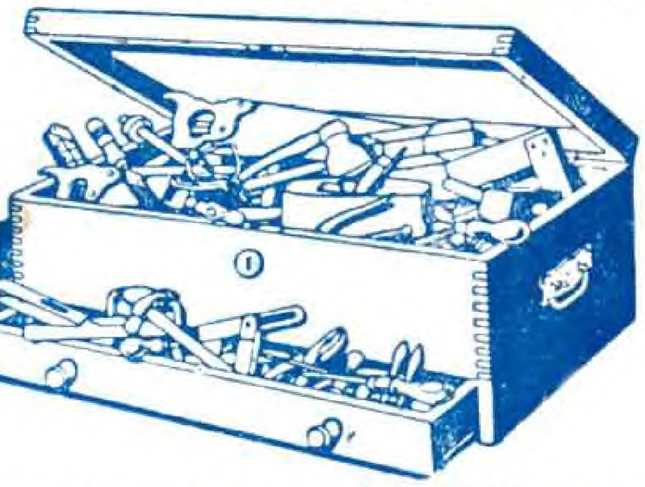
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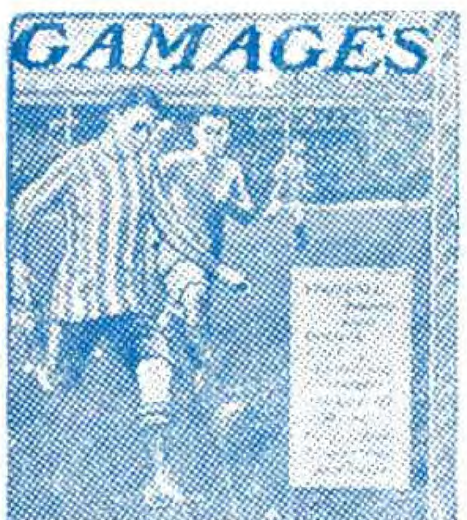


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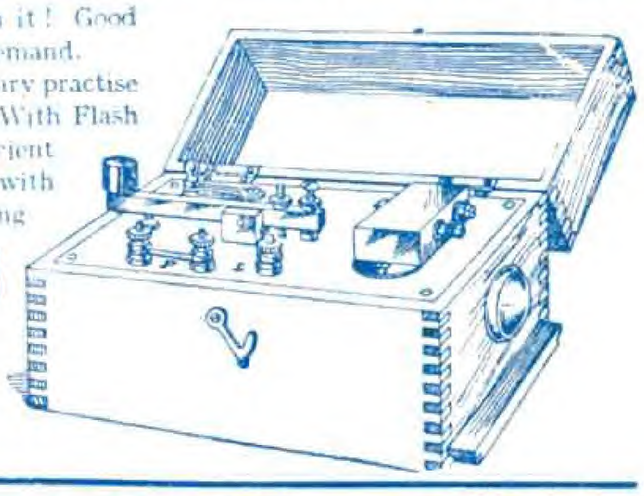
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